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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 5, NUMBER 8
APRIL 15, 1972

W72-04104 -- W72-04703

U.S. DEPARTMENT OF THE INTERIOR
OFFICE OF WATER RESOURCES RESEARCH
WATER RESOURCES SCIENTIFIC INFORMATION CENTER

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WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 5, NUMBER 8
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Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

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FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the

Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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(Use Edge Index on back cover to Locate Subject Fields and Indexes in the journal.)

01 NATURE OF WATER
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02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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04 WATER QUANTITY MANAGEMENT AND CONTROL
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06 WATER RESOURCES PLANNING
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07 RESOURCES DATA
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08 ENGINEERING WORKS
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09 MANPOWER, GRANTS AND FACILITIES
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10 SCIENTIFIC AND TECHNICAL INFORMATION
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1A. Properties

THE PROTON AFFINITY OF WATER,
Rice Univ., Houston. Dept. of Chemistry.
S. L. Chong, R. A. Myers, Jr., and J. L. Franklin.
Available from NTIS, Springfield, Va. 22151 as AD-730 471, $3.00 paper copy; $0.95 microfiche. Purdue University Project Squid Technical Report (Rice-11-PU), September 1971. 10 p, 2 tab, 9 ref. NR-098-038; ONR N00014-67-A-0226-0005.

Descriptors: *Water chemistry, *Ions, *Isotropy, Analytical techniques, Laboratory tests, Spectrometers, Free energy.
Identifiers: *Proton affinity of water, Reaction rate.

By employing elevated pressures in the ion source of a quadrupole mass filter, D3S (+) did not transfer a deuteron to D20 and D30 (+) transferred a deuteron to D2S. Studies were carried out in most instances under conditions where the reactant ion undergoes 30-60 collisions before reacting. Thus, most excess energy was removed. The transfer of deuteron from D30 (+) to D2S goes to equilibrium with an equilibrium constant of 14.4 which corresponds to a heat of reaction of 1.8 kcal/mole. From this the proton affinity of water was determined to be 168 kcal/mole. (Woodard-USGS)
W72-04533

EFFECTS OF TRACE ADDITIVES AND IMPURITIES ON THE PROPERTIES OF HIGH PURITY WATER,
Army Engineer Reactors Group, Fort Belvoir, Va.
For primary bibliographic entry see Field 05C.
W72-04554

1B. Aqueous Solutions and Suspensions

ELECTROCHEMICAL BEHAVIOR OF THE BORON ANODE IN AQUEOUS SOLUTIONS,
National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
B. S. Del Duca.
Available from NTIS, Springfield, Va. 22151, as NASA TND 6589. National Aeronautics and Space Administration technical note, January 1972. 16 p, 7 fig, 5 tab, 13 ref.

Descriptors: Electrochemistry, *Boron, *Anodes, *Oxidation, *Aqueous solutions, Sodium compounds, Nitrates, Hydrogen ion concentration, Diffusion, Acidity, Alkalinity, Water chemistry, Chemical reactions.
Identifiers: Boron anode, Oxidation potential.

The electrochemical oxidation of p-type boron in 0.2 N NaNO3 solutions of pH 0.4 to 13.1 was studied by galvanostatic techniques. The capacitance of the electrode, Tafel slopes, and a limited analysis of reaction mechanism are reported. The anodic dissolution in acid solution is a charge-transfer-limited one-electron reaction to form a monovalent species in the overpotential region of 0.25 to 0.70 V. The dissolution in basic solution is most probably a one-electron charge-transfer reaction from a monovalent to divalent species involving three hydroxyl ions. Open circuit potentials were mixed potentials, probably due to hydrogen formation at open circuit but not contributing to the electrochemical reaction at the applied overpotential. Exchange currents, estimated by extrapolation of the Tafel line to the standard oxidation potential for the boron reaction, were of the order of 0.000001 A/ sq. cm in acid solution and 10 to the minus 12th power A/sq. cm in basic solution. The reaction order of the rate determining acidic and basic reactions was determined with regard to the concentrations of H+ and OH-. The level of illumination had no effect on the electrochemical behavior of the electrode. (Woodard-USGS)
W72-04173

THERMODYNAMIC PROPERTIES OF AQUEOUS SOLUTIONS AT HIGH TEMPERATURES,
Westinghouse Electric Corp., Pittsburgh, Pa.
Chia-tsun Liu, and W. T. Lindsay, Jr.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price $1.75. Office of Saline Water Research and Development Progress Report No. 722, December 1971. 124 p, 26 fig, 38 tab, 46 ref. Contract No. 14-01-0001-2126.

Descriptors: *Sodium chloride, *Vapor pressure, *Thermodynamics, *Aqueous solutions, Sea water, Magnesium compounds, Entropy, Enthalpy, Physicochemical properties, Electrolytes, Ions, Thermal capacity, Boiling, Sulfates, Salts, Solubility, Osmosis.
Identifiers: Activity, Magnesium chloride.

Osmotic coefficients in aqueous salt solutions have been determined by vapor-pressure lowering measurements at temperatures from 75 deg to 300 deg C. Measurements on sodium chloride solutions were carried out at concentrations from approximately 4 molal up to saturation, thereby completing the thermodynamics of the sodium chloride-water system. Activity coefficients have been obtained for sodium chloride and many important thermodynamic functions have been calculated for water and salt for the complete concentration range. Uniquely precise solubility data of sodium chloride were obtained at temperatures up to 300 deg C. The system magnesium chloride-water was studied at temperatures from 75 deg to 300 deg C at concentrations 1.6 m to 5.2 m. The system magnesium sulfate-water was studied at temperatures from 75 deg to 175 deg C at concentrations 0.4 to 1.5 molal. Measurements were obtained on the system sodium-magnesium-chloride-sulfate-water for an ionic composition simulating sea water at concentration factors 1.5 to 10 times normal sea water at temperatures 75 deg to 300 deg C. Boiling point elevations calculated from these results are compared with previous estimates that were based on less extensive data. (OSW-Abstract)
W72-04354

02. WATER CYCLE

2A. General

STUDIES IN THE APPLICATION OF DIGITAL SIMULATION TO URBAN HYDROLOGY,
Hydrocomp International, Palo Alto, Calif.
N. H. Crawford.
Available from the National Technical Information Service as PB-206 715, $3.00 in paper copy, $0.95 in microfiche. Completion Report, September 1971. 100 p, 24 fig, 17 tab, 13 ref, 4 append. OWRR C-2159 (No 3375) (1).

Descriptors: *Urbanization, *Model studies, *Hydrologic data, *Data storage and retrieval, Mathematical models, Storm runoff, Floods, Data collections, Digital computers, Hydrologic budget, Water balance, Hydrologic cycle, Illinois, Texas, California.
Identifiers: *Sensitivity study, *Urban watersheds, Simulation, Waller Creek (Tex), Echo Park (Calif), Boneyard Creek (Ill).

The sensitivity of the Hydrocomp Simulation Program to changes in data interval, number of raingages and watershed definition was studied using data from Waller Creek, Austin, Texas; Boneyard Creek, Champaign-Urbana, Illinois; and Echo Park, Los Angeles, California. The lack of adequate hydrometeorological data severely hampered the study. None of the rainfall data were available in a computer compatible form and extensive data reduction was done from the recorder charts. The simulated response of Boneyard Creek was very insensitive to a change from 15-minute to 60-minute rainfall values and to a change from 3 raingages to only 1 raingage. The Waller Creek results were quite sensitive to changes in number of gages and also to changes in time interval. The Echo Park results indicated the need for 5-minute or shorter time interval rainfall for the very small and steep watersheds. The difficulty in finding suitable data indicates that more attention must be given to collecting and reducing urban hydrologic data in computer compatible form.
W72-04123

ELECTROMAGNETIC DISPERSION CURVES FOR NATURAL WATERS,
Hawaii Univ., Honolulu. Water Resources Research Center.
L. K. Lepley, and W. M. Adams.
Water Resources Research, Vol 7, No 6, p 1538-1547, December 1971. 24 fig, 5 ref. OWRR B-015-HI.

Descriptors: *Remote sensing, *Radar, *Radio waves, *Electromagnetic waves, *Water properties, Salinity, Electrolytes, Albedo, Water temperature.
Identifiers: *Electromagnetic dispersion.

The dispersion curves of the electromagnetic properties of water to radiation of 1 to 13,000 megahertz at normal incidence were computed and plotted for 39 salinity and temperature combinations. These graphs show that the frequency dispersion of the reflectance of radio energy in the 1-1,000 megahertz band at normal incidence to a smooth water surface is strongly influenced by the salinity of the water. The spectral signature can be used as a measure of water salinity as distinguished from water temperature. These curves should be of value to workers in remote sensing, hydrology, and limnology. (Knapp-USGS)
W72-04160

ANNUAL REPORT OF ACTIVITIES DURING FISCAL YEAR 1971.
Maine Univ., Bangor. Water Resources Center.
For primary bibliographic entry see Field 05C.
W72-04261

ESTIMATION OF LAKE FLUSHING RATES FOR WATER QUALITY CONTROL PLANNING AND MANAGEMENT,
Maine Univ., Orono. Water Resources Research Center.
Warren Wiessman, Jr.
Proceedings, Workshop--Conference on reclamation of Maine's dying lakes held at University of Maine, Bangor, March 24-25, 1971, p 50-66. 4 fig, 23 ref.

Descriptors: *Lakes, *Model studies, *Mathematical models, Planning, Water quality control, Maine, Hydrologic budget, Water circulation, Diffusion.
Identifiers: *Flushing rates.

The water budget of lakes and mahematical water quality models are reviewed. The development of input prediction equations requires monitoring of mixing, thermal conditions, currents, and other factors. Attention is called to the difficulties connected with exacting circulation analyses and the development of corresponding mathematical models of practical significance. An emphasis is placed on the value of rough estimates in water quality control planning. An estimate of both the maximum and minimum flushing rates is used as an illustration. (See also W72-04279) (Wilde-Wisconsin)
W72-04283

GEOLOGY, HYDROLOGY, AND QUALITY OF WATER IN THE MADERA AREA, SAN JOAQUIN VALLEY,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 02F.

W72-04334

RAINFALL-RUNOFF INVESTIGATIONS IN THE DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 04C.
W72-04513

ESTIMATION OF PROBABILITY DISTRIBUTION PARAMETERS BY GROUPS OF CORRELATED HYDROLOGIC SERIES (OB OTSENKE PARAMETROV RASPREDELENIYA VEROYATNOSTEY PO GRUPPAM KORRELYATIVNO SVYAZANNYKH GIDROLOGICHESKIKH RYADOV),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W72-04680

RELATIONSHIPS BETWEEN ESTIMATES OF PROBABILITY DISTRIBUTION PARAMETERS OF CORRELATED DEPENDENT VARIABLES (O SVYAZYAKH MEZHDU OTSENKAMI PARAMETROV RASPREDELENIYA VEROYATNOSTEY KORRELYATIVNO ZAVISIMYKH VELICHIN),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W72-04682

PATTERNS OF SUCCESSION OF DRY AND WET YEARS AS A BASIS FOR COMPUTING STREAMFLOW REGULATION (ZAKONOMERNOSTI CHEREDOVANIYA MALOVODNYKH I MNOGOVODNYKH LET KAK OSNOVA RASCHETOV REGULIROVANIYA RECHNOGO STOKA),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W72-04684

FIFTY YEARS OF SOVIET METEOROLOGY AND HYDROLOGY (METEOROLOGIYA I GIDROLOGIYA ZA 50 LET SOVETSKOY VLASTI).

Gidrometeoizdat, Leningrad, USSR, 1967. 278 p.

Descriptors: *Meteorology, *Climatology, *Hydrologic cycle, *Hydrologic budget, *Hydrologic data, Water resources, Water balance, Heat balance, Weather data, Weather modification, Weather forecasting, Atmospheric physics, Cloud physics, Cloud seeding, Artificial precipitation, Satellites (Artificial), Remote sensing, Exploration, Oceanography, Polar regions.
Identifiers: *USSR, Engineering hydrology, Satellite meteorology, Space sciences.

This collection of 18 papers deals with advances in Soviet meteorology and hydrology in the 50-year period from 1917. The text opens with an introductory paper by Academician Ye. K. Fedorov on the scientific, technical, and informational activities of the USSR Hydrometeorological Service, established in 1929 for development of hydrologic networks, and improvement and expansion of programs for investigation of water resources. Investigations of high atmospheric layers and air circulation, problems of long- and short-range weather forecasting, and Soviet achievements in the field of satellite meteorology are discussed in articles by Ye. G. Shvidkovskiy, Ye. N. Blinova, I. A. Kibel' and I. P. Vetlov. Results and prospects of utilizing the agroclimatic resources of the USSR are examined in a study by Academician F. F. Davitaya. Investigations of world heat balance, USSR water resources and water balance, Soviet engineering hydrology and water management, hydrologic forecasts, and the climate of the USSR are treated in separate articles by M. I. Budyko, K. P. Voskresenskiy, S..N. Kritskiy, Ye. G. Popov, and O. A. Drozdov. History of Soviet research activities in the Arctic and Antarctic and present-day exploration of these regions are reviewed by A. F. Treshnikov and Ye. S. Korotkevich. N. A. Volkov deals with long-range ice forecasts for polar seas. Soviet research on weather modification, artificial stimulation of rainfall, fog and cloud formation, and cloud seeding to control hailstorm damage is summarized by Ye. K. Fedorov, I. I. Gayvoronskiy, and G. K. Sulakvelidze. The collection concludes with a detailed chronology of the most important events in the field of Soviet meteorology, hydrology, oceanology, and Arctic and Antarctic explorations in the period 1917-1967. (Josefson-USGS)
W72-04685

WATER RESOURCES AND WATER BALANCE OF THE USSR (VODNYYE RESURSY I BALANS VOD SSSR),
K. P. Voskresenskiy.
In: Meteorologiya i gidrologiya za 50 let Sovetskoy vlasti; Gidrometeoizdat, Leningrad, USSR, p 125-142, 1967. 5 tab.

Descriptors: *Water resources, *Water balance, *Hydrologic cycle, *Hydrologic budget, *Hydrologic data, Water storage, Moisture content, Precipitation (Atmospheric), Streamflow, Runoff, Runoff coefficient, Evaporation, Groundwater, Fresh water, Surface waters, Bodies of water, Lakes, Reservoirs, Glaciers, Ice, Snow.
Identifiers: *USSR, Ice lenses.

Diversion of the natural water system of the USSR from excessively wet areas to dry regions is, and promises to remain, one of the country's major national issues. Average annual precipitation for the USSR is 531 mm (11,694 cu km), the maximum occurring on the Black Sea coast of the Caucasus. Average annual runoff of streams is 198 mm (4,358 cu km). Average annual evaporation is 333 mm (7,336 cu km), the maximum occurring in the same area of the Caucasus (700-800 mm). The average runoff coefficient is 0.37. Total volume of water from the country's more than 2,870,000 rivers, brooks, and ephemeral streams having a length greater than 0.5-1 km is 4,714 cu km a year. The annual runoff volume from the USSR is 4,384 cu km. Three moisture zones are distinguished: (1) excessively wet (northern, eastern and mountain regions), covering 48% of the country and representing 80% of the water resources; (2) moderately wet (middle latitudes), covering 25% of the country and representing 18% of the water resources; and (3) insufficiently wet, covering 27% of the country and representing only 2% of the water resources. Lakes in the USSR total 2,851,044 (of which more than 95% are fresh water) and cover an area of 486,000 sq km. Glaciers in the USSR cover an area of 76,312 sq km (volume--12,466 cu km). Maximum water storage in seasonal snow cover is located in mountain regions (up to 180-220 mm) and on Arctic shores (110-120 m). River ice lenses may attain sizes of 100 sq km and have volumes of 0.5-0.6 cu km. Total annual storage of renewable groundwater is 985 cu km, which is about 22% of the volume of all waters flowing from the USSR. Total freshwater storage is about 42,000 cu km and is concentrated in lakes (62.5%) and glaciers (26.4%). Annually renewable surface waters and groundwaters comprise 11% of total fresh-water storage and 37% of total annual precipitation. Current hydraulic engineering measures are proving successful in redistributing streamflow. (Josefson-USGS)
W72-04686

BIBLIOGRAPHY OF HYDROLOGY X, 1969, (HIDROLOGIAI BIBLIOGRAFIA X. 1969).
For primary bibliographic entry see Field 10.
W72-04688

2B. Precipitation

ELECTROMAGNETIC DISPERSION CURVES FOR NATURAL WATERS,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 02A.
W72-04160

A NEW METHOD FOR MEASURING THE DISSIPATION RATE OF TURBULENCE IN CLOUDS AND PRECIPITATION USING A CONVENTIONAL RADAR,
A. G. Gorelik, and Yu. V. Mel'nichuk.
Available from NTIS, Springfield, Va. 22151 as AD-731 558 $3.00 in paper copy, $0.95 in microfiche. Johns Hopins University Applied Physics Laboratory Translation Report CLB-3, T-629, April 22, 1971. 9 p, 1 fig, 1 tab, 6 ref. (Translation from Trudy Tret'ego Vsesoyuznoga Soveshchaniya Po Radiolokatsionnoi Meteorologii - Third All-Union Conf on Radar Meteorology, Moscow, 1968). Contract N00017-62-C-0604.

Descriptors: *Meteorology, *Radar, *Clouds, *Weather forecasting, *Precipitation (Atmospheric), Turbulence, Wind velocity, Analytical techniques.

Radar was used with various sounding pulse lengths for the study of dynamic processes in the atmosphere with emphasis on atmospheric turbulence and precipitation measurements. The radar emits sounding pulses ot different length alternately during a period of frequency iteration. A two-channel selector with proper frequency selection receives radar signal envelopes and their spectra simultaneously for two pulse lengths. Then changes in the turbulence mode, scatterer-size spectra, and mean wind speed will not affect the measurements of turbulent energy. This technique will allow measurement of the temporal variations of turbulent energy. (Woodard-USGS)
W72-04174

SANTA BARBARA PYROTECHNIC CLOUD SEEDING TEST RESULTS 1967-70,
North American Weather Consultants, Santa Barbara, Calif.
For primary bibliographic entry see Field 03B.
W72-04387

FORMATION OF A RAIN SHOWER BY SALT SEEDING,
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
For primary bibliographic entry see Field 03B.
W72-04388

ON THE RELATIONSHIP BETWEEN HORIZONTAL MOISTURE CONVERGENCE AND CONVECTIVE CLOUD FORMATION,
National Severe Storms Lab., Norman, Okla.
H. R. Hudson.
Journal of Applied Meteorology, Vol 10, No 4, p 755-762, August 1971. 4 fig, 1 tab, 10 ref.

Descriptors: *Clouds, *Cloud physics, *Convections, *Storm structure, *Rainfall, Storms, Latent heat, Moisture, Condensation, Atmosphere, Weather, Meteorology, Hydrologic data, Computer models, Forecasting, Radar.

A technique for determining the net effect of the latent heat released by cumulus convection on large-scale flow is evaluated for its applicability to regions of convection in middle latitude severe storm situations. The ratio of the vertically integrated horizontal moisture divergence to the moisture required for the development of a model cloud multiplied by a given arbitrary time interval is interpreted as the amount of model cloud

produced in that time interval. The model cloud is characterized by pseudoadiabatic temperature and moisture profiles above the lifting condensation level. The technique used computer methods and regularly available rawinsonde data. Well-defined axes of horizontal moisture convergence accompany development of strong cumulus convection, and the use of a pseudo-adiabatic cloud to model the moisture requirements gives reasonable predicted cloud amounts. The patterns of predicted cloud formation often correlate well with observed radar patterns of strong cumulus convection. (Woodard-USGS)
W72-04389

CALCULATION OF THE TERMINAL VELOCITY OF WATER DROPS,
Navy Weather Research Facility, Norfolk, Va.
H. B. Wobus, F. W. Murray, and L. R. Koenig.
Journal of Applied Meteorology, Vol 10, No 4, p 751-754, August 1971. 1 tab, 7 ref.

Descriptors: *Rainfall, *Drops (Fluid), *Velocity, *Cloud physics, *Mathematical studies, Analytical techniques, Numerical analysis, Evaluation.
Identifiers: Water drops, Terminal velocity, Still air.

Three mathematical expressions for the terminal velocity of water drops in still air as a function of equilavent radius are compared with the experimental data of Gunn and Kinzer. Two of the expressions, derived by curve-fitting techniques, give excellent results over the full range of meteorological interest, including the Stoke's law regime. A formula to correct for nonstandard pressure and temperature is given, and its results are compared with the experimental data of Beard and Pruppacher. (Woodard-USGS)
W72-04390

MEASUREMENTS OF PRECIPITATION PARTICLES IN WARM CUMULI OVER SOUTHEAST TEXAS,
Texas A and M Univ., College Station. Dept. of Meteorology.
For primary bibliographic entry see Field 03B.
W72-04391

A CONTACT NUCLEATION MODEL FOR SEEDED CLOUDS,
Meteorology Research, Inc. Altadena, Calif.
For primary bibliographic entry see Field 03B.
W72-04392

SOME MESOSCALE FEATURES OF THE INITIAL FIELDS OF MOTION AND TEMPERATURE FOR A LAKE-INDUCED WINTER DISTURBANCE,
Meteorological Service of Canada, Toronto (Ontario).
For primary bibliographic entry see Field 02H.
W72-04393

LOW-FREQUENCY PERIODICITIES IN PANAMA RAINFALL RUNOFF,
Sandia Lab., Albuquerque, N. Mex.
J. W. Reed.
Journal of Applied Meteorology, Vol 10, No 4, p 666-673, August 1971. 10 fig, 1 tab, 6 ref.

Descriptors: *Rainfall disposition, *Runoff, *Frequency analysis, *Hydrologic cycle, *Tropical regions, Statistical methods, Monsoons, Hydrologic data, Forecasting, Computers, Input-output analysis.
Identifiers: *Rainfall periodicities, Panama.

Daily measurements from seven watersheds in Panama, covering areas from 35-393 sq mi and periods of record from 13-57 years, were analyzed for rainfall-runoff periodicities. Rainfall and river runoffs from the Rio Chagres watershed is dominated by annual monsoon circulations. There is some complication apparently caused by a semi-annual oscillation, peaking just before the solstices. There is no sign of periodicities of 24-30 months which were thought might occur and be related to the quasi-biennial wind wave in the tropical stratosphere. There is likewise no sign of 11-year periodicities to relate to the sunspot cycle, nor 27.3-day periodicities to relate to the lunar cycle. There is, however, considerable inter-annual variation with return periods of 3-8 years, but this oscillation seems to be random. Finally there is no sign of synoptic-scale regularities such as 4- and 8-day peaks in power spectra of temperate latitude wind series. (Woodard-USGS)
W72-04395

WET PERIOD PRECIPITATION AND THE GAMMA DISTRIBUTION,
Kansas State Univ., Manhattan. Dept. of Statistics and Computer Science.
N. T. Ison, A. M. Feyerherm, and L. D. Bark.
Journal of Applied Meteorology, Vol 10, No 4, p 658-665, August 1971. 7 tab, 12 ref.

Descriptors: *Precipitation (Atmospheric), *Wet seasons, *Model studies, *Forecasting, *Kansas, Rainfall, Meteorological data, Statistical methods, Rainfall disposition.
Identifiers: Gamma distribution.

Using 66 years of daily precipitation data from three Kansas stations, a probability model was formulated to describe variation in precipitation amounts in a wet period. To allow for seasonal variation and parameter values, the data were divided into 13 four-week periods, the first beginning March 1 and the 13th ending February 27. For each four-week period, separate estimates of the parameters were obtained for wet periods lasting from one to six or more days. It was assumed that all one-day wet periods beginning in the first four-week period, regardless of the year they occurred, provided independent observations on a particular member of the family of gamma densities; likewise for two-day wet periods, three-day wet periods, etc. Comparing cumulative distributions of four-week precipitation totals from observed data with that obtained by a simulation program supported the proposed model for simulation of precipitation patterns. (Woodard-USGS)
W72-04396

CHEMICAL COMPOSITION OF ATMOSPHERIC PRECIPITATION IN THE NORTHEASTERN UNITED STATES,
Geological Survey, Washington, D.C.
F. J. Pearson, Jr., and D. W. Fisher.
Available from GPO, Washington, D.C. 20402 - Price $0.25 cents (paper cover). Geological Survey Water-Supply Paper 1535-P, 1971. 23 p, 7 fig, 3 tab, 17 ref.

Descriptors: *Water chemistry, *Precipitation (Atmospheric), *Hydrologic data, *Northeast U.S., Data collections, Sampling, Correlation analysis, Geochemistry, Streams, Atmosphere, Chemical analysis, Fallout.
Identifiers: *Chemical analysis (Atmospheric precipitation).

Monthly bulk precipitation samples were collected from 18 sites in New York, Pennsylvania, and New England during periods that lasted from 12 to 36 months. The samples were analyzed for calcium, magnesium, sodium, potassium, ammonium, hydrogen ion, bicarbonate, sulfate, chloride, nitrate, and phosphate. The analytical results were combined with precipitation amounts to get annual average loads of the various ionic species as thousandths of a ton per day per square mile. Chemical loads in precipitation falling on several basins in the northeastern region were compared with loads carried by unpolluted streams draining the same basins. In all cases, the total nitrogen loads in precipitation entering the basins are greater than the total nitrogen loads being carried out by the streams. In dilute streams substantially all sulfate present is precipitation-derived. Comparing the chemistry of precipitation with that of water from the Magothy aquifer, Long Island, N.Y., shows that the precipitation chemistry greatly affects the chemistry of this groundwater. (Woodard-USGS)
W72-04515

A COMPUTERIZED METHOD OF PRECIPITATION DATA QUALITY CONTROL,
Utah State Univ., Logan. Coll. of Engineering.
For primary bibliographic entry see Field 07C.
W72-04657

FIFTY YEARS OF SOVIET METEOROLOGY AND HYDROLOGY (METEOROLOGIYA I GIDROLOGIYA ZA 50 LET SOVETSKOY VLASTI).
For primary bibliographic entry see Field 02A.
W72-04685

2C. Snow, Ice, and Frost

GEOLOGY OF MCLEAN COUNTY, NORTH DAKOTA,
North Dakota Geological Survey, Grand Forks.
For primary bibliographic entry see Field 02J.
W72-04170

THE POSSIBLE IMPORTANCE OF ELECTRICAL FORCES IN THE DEVELOPMENT OF SNOW CORNICES,
Manchester Univ. (England). Inst. of Science and Technology; and Manchester Univ. (England). Dept. of Physics.
J. Latham, and J. Montagne.
Journal of Glaciology, Vol 9, No 57, p 375-384, 1970. 2 fig, 4 tab, 25 ref. OWRR-B-003-MONT (2).

Descriptors: *Electrical studies, *Snowpacks, *Electrical properties, Alpine, Melting, Adhesion, Snow cover, Deposition (Sediments), Snowfall.
Identifiers: *Electrical forces, *Snow cornices.

Measurements were made of the vertical electric field strength around snow cornices on Bridger Ridge (2,590 m a.s.l.) in the Bridger Range, southwestern Montana. The fields were considerably enhanced, owing to the exposed position of the cornices, but were nevertheless appreciably lower than those necessary to provide significant additional bonding when ice crystals collide with an ice surface. The charges carried on snow crystals saltating over the surface of cornices were close to their limiting values. Pressure melting is unlikely to be of importance in the development of snow cornices formed from granular crystals, frictional melting is probably significant only at fairly low temperatures and moderately high wind velocities, and strong electrostatic forces between highly charged snow crystals saltating over the surface of a cornice may be sufficient to provide bonding where the crystal velocities are comparatively low. (Knapp-USGS)
W72-04176

THE CRYSTALLIZATION PRESSURE OF ICE--A SIMPLE EXPERIMENT,
Bristol Univ. (England). H. H. Wells Physics Lab.
D. C. Connell, and J. M. C. Tombs.
Journal of Glaciology, Vol 10, No 59, p 312-315, 1971. 3 fig, 9 ref.

Descriptors: *Pressure, *Crystal growth, *Ice, Cryology, Frost action, Stress, Laboratory tests, Instrumentation.
Identifiers: Crystallization pressure (Ice).

Polycrystalline ice, growing from the melt, can exert a pressure against an extended obstacle, even though it is free to grow in other directions. Pressures of over 0.2 bar were measured with simple apparatus. This pressure may be important in

explaining the frost-shattering of rocks. (Knapp-USGS)
W72-04177

CHLORIDE SEGREGATION ALONG GRAIN BOUNDARIES IN ICE,
National Center for Atmospheric Research, Boulder, Colo.
F. Prodi, and C. T. Nagamoto.
Journal of Glaciology, Vol 10, No 59, p 299-308, 1971. 10 fig, 9 ref.

Descriptors: *Freezing, *Crystal growth, *Ice, *Cryology, *Water chemistry, Chemical analysis, Analytical techniques, Crystallography.
Identifiers: Chloride segregation (Ice).

A new technique for precisely detecting chlorides in ice is based on a microchemical contact reaction which takes place when a thin surface layer of ice melts through a membrane filter previously soaked in a concentrated solution of silver nitrate and dried. The silver chloride thus formed is reduced to metallic silver uner ultraviolet light. On natural hailstones and laboratory doped ice, foreign molecules are mainly segregated along the grain boundaries rather than being captured in the ice lattice. (Knapp-USGS)
W72-04178

NEW DATA ON THE THERMAL CONDUCTIVITY OF NATURAL SNOW,
Alaska Univ. College. Geophysical Inst.
G. E. Weller, and P. Schwerdtfeger.

Descriptors: *Snow, *Thermal conductivity, Mathematical studies, Cryology, Crystallography, Heat flow, Ice, Firn, Density.

The thermal conductivity and diffusivity of natural snow computed from Fourier-type analyses of annual snow temperature variations are strongly temperature dependent. The computed temperature coefficients of -0.007 per deg C and -0.012 per deg C respectively, agree well with laboratory experiments carried out on polycrystalline ice. (Knapp-USGS)
W72-04179

THE EFFECT OF IMPURITIES ON THE SURFACE STRUCTURE OF EVAPORATING ICE,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
J. D. Cross.
Journal of Glaciology, Vol 10, No 59, p 287-292, 1971. 6 fig, 10 ref.

Descriptors: *Ice, *Melting, *Salts, *Crystallography, *Electron microscopy, Freezing, Aqueous solutions, Water chemistry, Crystallization, Crystal growth, Sublimation, Cryology.

Studies of polycrystalline ice surfaces with a scanning electron microscope reveal a complex surface structure containing fine filaments less than one micrometer thick. Impurities that enter the ice lattice substitutionally enhance the fine structure on the surface, but impurities rejected by the lattice suppress the fine structure. The observed fine structure is a real property of evaporating ice, dependent upon the defects at the surface. Ammonium ions and fluoride ions are only incorporated in the lattice in small quantities, therefore when water containing 100 ppm of NH4OH, HF, or NH4Cl is frozen some of these impurities are rejected and accumulate at the grain boundaries. In the case of NH4OH the impurity is more volatile than the ice, and during evaporation the concentration of impurity at grain boundaries remains small. In the case of HF and NH4Cl, evaporation results in an accumulation of impurities and the surface structure in these cases is less prominent. In the case of NaCl and HCl, the impurities are rejected and no surface structure develops. (Knapp-USGS)
W72-04180

CALCULATION OF GRAIN-BOUNDARY THICKNESS IN POLYCRYSTALLINE ICE OF LOW SALINITY,
Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Chemistry.
A. K. Chatterjee, and H. H. G. Jellinek.
Journal of Glaciology, Vol 10, No 59, p 293-297, 1971. 1 fig, 1 tab, 9 ref. OSW Grant 14-01-0001-1122.

Descriptors: *Crystallography, *Ice, *Cryology, *Salinity, *Crystallization, Crystal growth, Temperature, Melting, Freezing, Particle size, Particle shape, Stress, Strain, Strength of materials, Deformation.

Grain-boundary thickness in polycrystalline ice is a function of time, salinity, temperature, and mode of sample preparation. It is directly proportional to the salinity of the ice and the number-average grain diameter or edge-length. Practically the total salt content resides in the grain boundary in low salinity ice samples. The grain-boundary thickness is exponentially related to growth time of the grains and increases exponentially with absolute temperature for constant salinity and age. The energy of activation for growth increases with salinity. The results of the grain-boundary thickness calculations are useful for evaluating grain-boundary diffusion coefficients. (Knapp-USGS)
W72-04181

OXYGEN-ISOTOPE MEASUREMENTS ON 1700 PLUS OR MINUS 300 YEAR OLD ANTARCTIC ICE,
Ohio State Univ. Research Foundation, Columbus. Inst. of Polar Studies.
W. L. Hamilton.
Journal of Glaciology, Vol 10, No 59, p 316-318, 1971. 1 fig, 1 tab, 5 ref.

Descriptors: *Snowfall, *Snowpacks, *Antarctic, *Tracers, *Stable isotopes, Oxygen, Precipitation (Atmospheric), Sampling, Cores.
Identifiers: *Byrd Station (Antarctica).

Values of 0-18 relative to standard mean ocean water (SMOW) measured on ice from 250 m depth at old Byrd station, Antarctica, averaged about -33%. A monotonic trend in values through the 16 cm long core piece suggested that part of an annual layer was represented. Snow accumulation was in excess of 14.4 g per sq cm per year at 1,700 years B P. (Knapp-USGS)
W72-04182

ICE-CORED MORAINES IN SOUTH-WESTERN ELLESMERE ISLAND, N.W.T., CANADA,
Brussels Univ. (Belgium). Geomorphology Service.
R. A. Souchez.
Journal of Glaciology, Vol 10, No 59, p 245-254, 1971. 4 fig, 3 tab, 10 ref.

Descriptors: *Glacial drift, *Erosion, *Sediment transport, Arctic, Regimen, Glaciation, Provenance, Sediment yield, Scour.
Identifiers: *Moraines, *Ice-cored moraines.

The northwest margin of the main ice cap in southwestern Ellesmere Island is fringed by ice-cored moraines. The formation of these moraines seems to be more complex than simple upwarping of the foliation bands at the margin of the ice cap. At one locality, where outer and inner zones can be distinguished on the basis of lithological composition, debris in the outer zone is composed of material from farther back under the ice cap than debris in the inner zone. In another locality, localized ridges cross each other independently of the trend of the main ridge. The time required to obtain the quantity of debris forming the moraine at the ice surface is estimated to be between 65 and 200 years. (Knapp-USGS)
W72-04183

AN ANALYSIS OF THE RELATION BETWEEN THE SURFACE AND BEDROCK PROFILES OF ICE CAPS,
Department of Supply, Melbourne (Australia). Antarctic Div.
W. F. Budd, and D. B. Carter.
Journal of Glaciology, Vol 10, No 59, p 197-209, 1971. 7 fig, 2 tab, 22 ref.

Descriptors: *Glaciers, *Flow, *Rheology, Movement, Viscosity, Shear stress, Topography, Surveys, Sounding, Profiles, Slopes, Arctic, Antarctic, Glaciation.
Identifiers: *Greenland ice cap, *Wilkes Ice Cap (Antarctica).

Surface and bedrock profiles were studied by spectral analysis along a flow line of the Wilkes ice cap and the surface along the Greenland EGIG profile. Although the bedrock appears irregular over all wavelengths studied, the ice-cap surface is typically characterized by a smooth curve with small-scale surface undulations superimposed on it. The damping factor or ratio of the bedrock amplitude to the surface amplitude is a minimum for wavelengths about 3.3 times the ice thickness. The surface lags the bed in the direction of motion by 1/4 the wavelength. The magnitude of the minimum damping factor is typically least near the coast, and increases inland depending on the ice thickness, velocity, and the mean ice viscosity (which is a function of stress and temperature). The damping factor provides a valuable means of estimating the viscosity. (Knapp-USGS)
W72-04184

MOVEMENT OF THE WARD HUNT ICE SHELF, ELLESMERE ISLAND, N.W.T., CANADA,
New Brunswick Univ., Fredericton. Dept. of Surveying Engineering.
E. Dorrer.
Journal of Glaciology, Vol 10, No 59, p 211-225, 1971. 7 fig, 6 tab, 16 ref.

Descriptors: *Sea ice, *Glaciers, *Arctic, *Strain, *Movement, Ice, Shear stress, Viscosity, Stress, Temperature, Creep.
Identifiers: Ward Hunt Ice Shelf, Ellesmere Island (Canada).

The movement of the Ward Hunt Ice Shelf, northern Ellesmere Island, was determined by repeated survey measurements at a marginal location. Ice velocity was 0.53 m/year. The ridge-and-trough structure on the ice shelf surface is not originated by internal ice forces. Effective shear strain-rate is 0.000101 per yr. The actual horizontal principal stresses are 0.65 bar and 0.02 bar. (Knapp-USGS)
W72-04185

OBSERVATIONS ON A SURGING GLACIER IN EAST GREENLAND,
Bern Univ. (Switzerland). Mineralogisches-Petrographisches Institut.
H. Rutishauser.
Journal of Glaciology, Vol 10, No 59, p 227-236, 1971. 6 fig, 5 ref.

Descriptors: *Glaciers, *Flow, *Movement, Arctic, Surveys, Glacial drift, Ice, Sediments, Provenance, Rheology, Regimen.
Identifiers: *Surging glaciers, *Greenland.

Bjornbo Gletscher (lat. 71 deg N., long. 25 deg W.), East Greenland, has several features characteristic of surging glaciers. One outstanding feature is the occurrence of drop-like ice masses in the lower parts of the glacier which do not appear to belong to the main glacier. A detailed petrographic comparison was made between the morainic debris surrounding these ice masses and the rocks occurring in the upper part of the glacier. These drop-like ice masses have been inserted into the main glacier; their drop-like form is due to ice transport from the side valleys, which occurred

over a short period of time during the surge of the main glacier. Because of the highly variable rock types occurring in the respective accumulation zones, petrographic examinations of other moraines in the ablation zone are used to trace them back to their respective firn fields. The main glacier and the tributary glaciers are now static. Bjornbo Gletscher can therefore be characterized by both static and moving phases, and its dynamics are those of surging glaciers. The quiescent phase is estimated to have been about 100 years. The next surge may occur around 1990. (Knapp-USGS)
W72-04340

SMALL-SCALE STRAIN MEASUREMENTS ON A GLACIER SURFACE,
Washington Univ., Seattle. Geophysics Group.
S. C. Colbeck, and R. J. Evans.
Journal of Glaciology, Vol 10, No 59, p 237-243, 1971. 5 fig, 10 ref.

Descriptors: *Glaciers, *Strain, *Flow, Topography, Movement, Rheology, Freezing, Melting, Surveys, Laminar flow, Plasticity, Viscosity.
Identifiers: Crevasses.

Surface deformations in the neighborhood of a crevasse field were measured over short (3 m) gage lengths in order to study flow conditions associated with crevasse formation. The results obtained were unusual in that they were inconsistent with large-scale results found by previous workers. The presence of small-scale surface effects, such as fractures, pot-holes and healed crevasses give rise to small-scale deformation fields with large spatial and temporal variations. There is a lower limit of gage length below which deformation measurements pertinent to regional flow phenomena cannot be made. This lower limit is apparently an order of magnitude greater than the spacing of the features which give rise to localized effects. (Knapp-USGS)
W72-04341

STRESS VARIATIONS WITH ICE FLOW OVER UNDULATIONS,
Department of Supply, Melbourne (Australia). Antarctic Div.
W. F. Budd.
Journal of Glaciology, Vol 10, No 59, p 177-195, 1971. 4 fig, 2 tab, 13 ref, append.

Descriptors: *Glaciers, *Movement, *Rheology, Strain, Stress, Flow, Slopes, Plasticity, Shear stress, Viscosity, Velocity.

The analysis of steady-state flow over bedrock perturbations is extended to evaluate the stress variations associated with the flow. In particular the four separate terms of the fundamental one-dimensional (longitudinal) stress equation are examined to show explicitly how the longitudinal stress gradient, the base stress, the surface slope stress, and the integrated second derivative of the shear stress (T) all vary over a given wave. The basal stress varies over the undulations in a similar way to the longitudinal stress gradient, and this is the same as the surface slope stress for long waves, but for short waves requires the addition of the fourth term, T, which then becomes dominant. (Knapp-USGS)
W72-04342

USE OF WORKING FORMULAS TO COMPUTE PARAMETERS OF MOVEMENT OF CERTAIN TYPES OF AVALANCHES IN THE CARPATHIANS (O PRIMENENII RASCHETNYKH FORMUL DLYA OPREDELENIYA PARAMETROV DVIZHENIYA NEKOTORYKH TIPOV LAVIN V RAYONE KARPAT),
B. I. Novikov.
In: Sbornik rabot po gidrologii, No 9; Gosudarstvennyy Gidrologicheskiy Institut, Leningrad, Gidrometeoizdat, p 169-176, 1970. 1 fig, 2 tab, 18 ref.

Descriptors: *Avalanches, *Mass wasting, *Snowpacks, *Snowfall, *Winds, Wind velocity, Density, Slopes, Orography, Mountains.
Identifiers: *USSR, *Carpathians, *Snow avalanches, Slab avalanches, Avalanche cones, Avalanche channels, Avalanche factor.

Studies were conducted in 1966-68 in the Chernogorskiy Range, the highest region in the Central Carpathians, to obtain general information on avalanche areas, types of avalanches, and, in particular, their formation and descent. The main avalanche factor in the area is wind transport of snow. Southwesterly winds prevail in winter with a frequency up to 50% and with a velocity reaching 40 m/sec. The bulk of falling snow is transported to the leeward slopes where avalanches form. If snow accumulates slowly on leeward slopes, the forming avalanches will consist of compact drift or metamorphosed snow with a density of 0.20-0.40 g/cu cm. During heavy snowfalls and weak winds of no more than 5-6 m/sec, snow deposition on slopes will lead to avalanches of new loose snow with a density of 0.12-0.18 g/cu cm. Study of avalanche areas, avalanche cones, and avalanche channels give an idea of the possible nature of movement of these two avalanche types. Movement of compact drift or metamorphosed snow avalanches may best be described by the laws of mechanics. Movement of new loose snow avalanches is of a hydraulic nature. Two working formulas are given for computing various parameters of avalanche movement. For new snow avalanches a fairly clear relationship was established between the drag coefficient and the density of the avalanche snow. Further accumulation of experimental data will make it possible to refine theoretical and empirical premises of the applicability of these formulas for determining parameters of avalanche movement in the Carpathians. (Josefson-USGS)
W72-04359

PRE-WISCONSIN GLACIAL DIVERSION OF THE HOUSATONIC RIVER IN NORTHWESTERN CONNECTICUT,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W72-04375

THE PREGLACIAL KENTUCKY RIVER OF NORTHERN KENTUCKY,
Geological Survey, Erlanger, Ky.
For primary bibliographic entry see Field 02J.
W72-04376

GLACIATION OF THE RAY MOUNTAINS, CENTRAL ALASKA,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02J.
W72-04377

AN ESTIMATE OF THE HEAT BALANCE OF A VALLEY AND HILL STATION IN CENTRAL ALASKA,
Alaska Univ., College. Geophysical Inst.
G. Wendler.
Journal of Applied Meteorology, Vol 10, No 4, p 684-693, August 1971. 8 fig, 2 tab, 31 ref.

Descriptors: *Hydrologic cycle, *Heat balance, *Snowmelt, *Alaska, Evaporation, Condensation, Runoff, Precipitation (Atmosphere), Vegetation, Permafrost, Surveys, Hydrologic data.
Identifiers: Spring floods.

The heat balance was estimated and climatic elements were compared for two stations in the Fairbanks, Alaska area on a year-round basis. Although the stations were situated near to each other (within 5 km and 200 m altitude), great differences were observed. For the valley station the heat source is mainly radiation with 61 cal/sq cm for an average day of the year August 1966 to July 1967. For the hill station the heat fluxes are generally smaller. Runoff at the study site is small because the surface is flat, the thick vegetation cover prevents surface runoff, and groundwater circulation is prevented by the permafrost silt. Great amounts of water remain on the uneven surface, and in the vegetation layer, after the flooding is over; this extra water explains the very high evaporation during the summer months. The maximum is found in June 1967 with 3.6 mm daily. In winter, condensation was recorded during November and December 1966, while January 1967 the evaporation equaled the condensation. The condensation values were small, the maximum being observed in December with 0.3 mm/day. (Woodard-USGS)
W72-04394

PROCEEDINGS OF THE THIRD CANADIAN CONFERENCE ON PERMAFROST, 14 AND 15 JANUARY 1969.

National Research Council of Canada Associate Committee on Geotechnical Research, Technical Memorandum No 96, September 1969. 207 p.

Descriptors: *Permafrost, *Arctic, *Subarctic, *Cold weather construction, Conferences, Mining, Mining engineering, Frozen ground, Cold regions, Surveys, Road construction, Foundations, Drilling, Oil wells, Oil fields.

The theme of this Conference proceedings is permafrost problems as they are related to the mining, oil, and gas production industries. Permafrost is several hundreds to more than 1,000 feet thick in the continuous zone and the active layer is generally 1 to 3 feet thick. In the discontinuous zone, permafrost is interspersed with areas of unfrozen ground. In the northern part of this zone, permafrost is widespread varying in thickness from about 50 to 200 feet. In the southern part of the zone, permafrost occurs in scattered islands, ranging in size from a few square feet to several acres, and varying in thickness from a few feet to a maximum of about 50 feet. The active layer is thicker than in the continuous zone and it does not extend everywhere to the permafrost table. Tundra polygons and pingos are among the most distinctive permafrost surface features in the continuous zone. In the southern part of the discontinuous zone, the most distinctive permafrost feature is the palsa. These peat mounds have a core of permafrost with a peat cover. The existence of large masses of ground ice is immediately evident where such features as pingos and ice wedge polygons occur. Many areas where ground ice occurs, however, may not exhibit any surface manifestation and its presence can only be inferred from the type of earth materials. (See W72-04522 thru W72-04532) (Knapp-USGS)
W72-04521

PERMAFROST IN THE KNOB LAKE IRON MINING REGION,
McGill Univ., Montreal (Quebec). Sub-Arctic Research Lab.
B. G. Thom.
In: Proceedings of Third Canadian Conference on Permafrost, 14 and 15 January 1969; National Research Council of Canada Associate Committee on Geotechnical Research, Technical Memorandum No 96, p 9-20, September 1969. 6 fig, 5 ref.

Descriptors: *Permafrost, *Surveys, *Mining, Seismic studies, Electrical studies, Exploration, Mining engineering, Frozen ground, Cold regions, Subarctic, Geophysics.
Identifiers: Knob Lake (Quebec), Canada.

Permafrost in central Labrador-Ungava, Canada, occurs as discontinuous bodies of various shapes and sizes within the upland terrain above approximately 2,220 feet in elevation. The active layer varies from 5 to 10 feet in depth, and if there is no permafrost below that layer then the groundwater circulates freely in aquifers. Particularly under exposed windswept ridges, free of tree cover, permafrost or perennially frozen ground can extend

to depths of 250 feet. These permafrost bodies are commonly elliptical in cross-section and are elongated parallel with rock strike and ridge crest trend. Ground temperatures vary from 25 to 32 deg F, and vertical isotherms at the freezing point parallel the slopes of ridges indicating sharp plunging boundaries to the permafrost. These boundaries often transgress rock types, and appear to be in close adjustment with surface climatic and vegetation conditions. Occasionally, pods of frozen ground are encountered at depths of 150 to 200 feet. These may be relics of colder climates during the Pleisticene. (See also W72-04521) (Knapp-USGS)
W72-04522

A TWO-DIMENSIONAL APPROACH TO AVALANCHE PROBLEMS,
Colorado State Univ., Fort Collins.
H. W. Shen.
In: Ice Engineering and Avalanche Forecasting and Control, Proceedings of Conference held at Calgary University, October 23-24, 1969: National Research Council of Canada Associate Committee of Geotechnical Research Technical Memorandum No 98, p 140-152, 1970. 6 fig, 5 ref.

Descriptors: *Avalanches, *Forecasting, *Density, Hazards, Snowfall, Weather forecasting, Snowpacks, Meteorology, Statistical methods, Snow management, Strength, Snow surveys.
Identifiers: *Avalanche forecasting, Canada.

A two-dimensional model of avalanches uses a fluid mechanics principle to describe the phenomenon. Due to either gravity or outside disturbances, or both, a slab of snow may crack along a fracture line and start sliding. During the fracture or sliding processes, the slab breaks into many small pieces. If the snow is wet, compact, and relatively stable, the snow slabs will not be ground into powder and usually will halt after a short distance. If the snow is not compact, the track is long, or the ground slope increases downhill, a slab avalanche may become a powder avalanche. A series of vortices with a rapidly decreasing magnitude travel in front of the avalanche. Theoretically, a mature powder snow avalanche, travelling on top of compacted snow, can move fast. Mature powder avalanches usually occur when there is a deep, soft snow slab in the starting zone and at least 2 feet of cold, dry, new snow covering a cold, compact running surface. It is difficult to predict which type of avalanche will occur on a given slide track. If the track is long enough, almost any type of avalanche may occur. (See also W72-04521) (Knapp-USGS)
W72-04523

AVALANCHE HAZARD EVALUATION AND FORECAST--ROGERS PASS, GLACIER NATIONAL PARK,
Rogers Pass, Department of Indian Affairs and Northern Development, (British Columbia). National and Historic Parks Branch.
V. G. Schleiss, and W. E. Schleiss.
In: Ice Engineering and Avalanche Forecasting and Control, Proceedings of Conference held at Calgary University, October 23-24, 1969; National Research Council of Canada Associate Committee of Geotechnical Research Technical Memorandum No 98, p 115-122, 1970.

Descriptors: *Avalanche, *Forecasting, Hazards, Snowfall, Weather forecasting, Snowpacks, Meteorology, Statistical methods, Snow management, Strength, Snow surveys.
Identifiers: *Avalanche forecasting, Canada.

Avalanche hazard evaluation and forecast are a part of the mobile avalanche defense for the Trans-Canada-Highway and the Canadian-Pacific-Railroad through Glacier National Park, B. C. To obtain the information required for the avalanche hazard evaluation and forecast, snow observations are taken at snow study areas along the 27 miles of highway. Factors used for the avalanche hazard evaluation include stability factor, a basic stability criteria for the area; depth of the critical shear plane; penetration test; wind speed and direction; relative humidity; and avalanche patrols. A good avalanche hazard evaluation and a reliable weather forecast are the basic requirements for an efficient avalanche hazard forecast. The forecast evaluation can be made on a numerical basis, allowing basic values for each factor, or (as preferred), in a graphical manner by plotting a storm profile. Evaluation and the forecast are based about 60% on data and 40% on the experience and intuition of the avalanche hazard forecaster. (See also W72-04521) (Knapp-USGS)
W72-04524

PRINCIPLES OF AVALANCHE FORECASTING,
Washington Univ., Seattle. Dept. of Atmospheric Sciences.
E. R. LaChapelle.
In: Ice Engineering and Avalanche Forecasting and Control, Proceedings of Conference held at Calgary University, October 23-24, 1969; National Research Council of Canada Associate Committee of Geotechnical Research Technical Memorandum No 98, p 106-113, 1970. 1 fig, 4 ref.

Descriptors: *Avalanches, *Forecasting, Hazards, Snowfall, Weather forecasting, Snowpacks, Meteorology, Statistical methods, Snow management, Strength, Snow surveys.
Identifiers: *Avalanche forecasting, Canada.

Two main functions of avalanche forecasting are: The avalanche hazard evaluation, or the estimation of currents now stability, and the avalanche forecast, or the prediction of future snow stability. The meteorological method deals largely with direct-action avalanches and evaluates unconditionally probable avalanche release in a given area. The structure method examines snow strength and layer patterns to identify latent hazards. Realization of these latent hazards is conditional on subsequent weather events. In practice the two methods are usually combined, but the emphasis shifts with climate. Hazard evaluation as practiced today is strongly empirical. Although the principles rest on a firm base of qualitative observations, it is still as much an art as a science. (See also W72-04521) (Knapp-USGS)
W72-04525

THE FLEXURAL STRENGTH OF SEA ICE AS DETERMINED FROM SALINITY AND TEMPERATURE PROFILES,
Cold Regions Research and Engineering Lab., Hanover, N.H.
G. E. Frankenstein.
In: Ice Engineering and Avalanche Forecasting and Control, Proceedings of Conference held at Calgary University, October 23-24, 1969; National Research Council of Canada Associate Committee of Geotechnical Research Technical Memorandum No 98, p 66-73, 1970. 2 fig, 1 tab, 7 ref.

Descriptors: *Ice, *Strength, *Testing, *Strength of materials, Sea ice, Lake ice, Deflection, Deformation, Design data, Salinity, Temperature.
Identifiers: *Flexural strength (Ice).

Large in-place cantilever beam tests were made on sea ice. Strength values were used to compute the constants of the strength equation based on profile relationship. Profile relationships are based on change in brine volume. The salinity and temperature profile of the beam were measured immediately after failure. The average of all strength values is 7.75 kg/sq cm. (See also W72-04521)
W72-04526

VIBRATION OF A FLOATING ICE SHEET,
Army Terrestrial Science Center, Hanover, N.H.
D. E. Nevel.
In: Ice Engineering and Avalanche Forecasting and Control, Proceedings of Conference held at Calgary University, October 23-24, 1969: National Research Council of Canada Associate Committee of Geotechnical Research Technical Memorandum No 98, p 57-65, 1970. 5 fig, 2 ref.

Descriptors: *Ice, *Vibrations, *Resonance, *Mechanical properties, Stress, Strain, Strength of materials, Deflection, Lake ice, Sea ice.

Analytical solutions are derived for the forced and free vibrations of a plate floating on water. The critical frequency is small and the amplification of the stress at this frequency is small for the forced vibration of a floating ice sheet. However, forced vibration may still be a problem because the fatigue of the ice is less than the static strength. (See also W72-04521) (Knapp-USGS)
W72-04527

ANALYSIS OF FORCES IN A PILE-UP OF ICE,
Monti, Lavoie and Nadon, Montreal (Quebec).
J. L. Allen.
In: Ice Engineering and Avalanche Forecasting and Control, Proceedings of Conference held at Calgary University, October 23-24, 1969; National Research Council of Canada Associate Committee of Geotechnical Research Technical Memorandum No 98, p 49-56, 1970. 3 fig.

Descriptors: *Ice loads, *Loads (Forces), *Ice jams, Lake ice, Sea ice, Ice, Hydraulic structures, Bridges, Engineering structures, Piers.
Identifiers: *Ice pressure (Structures).

The effective force of ice in any area may be determined from the piles of ice found in that area. All ice that is forced up the side of a pileup has already been broken from the ice sheet. The force that is pushing it, however, is the force developed by the unbroken sheet behind it. Therefore, the height of the pile is related to the strength of the ice sheet. If the height of the pileup, the density in the pile, and the thickness of the ice forming the pile is measured, the effective force of the ice on a broad front can be calculated. (See also W72-04521) (Knapp-USGS)
W72-04528

EFFECTIVE FORCE OF FLOATING ICE ON STRUCTURES,
Monti, Lavoie and Nadon, Montreal (Quebec).
J. L. Allen.
In: Ice Engineering and Avalanche Forecasting and Control, Proceedings of Conference held at Calgary University, October 23-24, 1969; National Research Council of Canada Associate Committee of Geotechnical Research Technical Memorandum No 98, p 41-48, 1970. 5 fig, 4 ref.

Descriptors: *Ice loads, *Loads (Forces), *Ice jams, Lake ice, Sea ice, Ice, Hydraulic structures, Bridges, Engineering structures, Piers.
Identifiers: *Ice pressure (Structures).

The literature concerning ice pressure was reviewed to establish a formula that can easily be used as a basis for calculating or checking effective pressure on structures. This formula can then be changed or improved to include other significant factors. Korzhavin's equation was used as a basis from which to begin. The effective force P is made up of the compressive strength modified by various independent factors. The velocity factor shows a reduction of strength as velocity increases. The contact factor expresses the percentage of contact between the obstacle and the ice. The indention factor indicates comparative effective pressures with respect to the size of the obstacle or pier with reference to the thickness of the ice. Higher effective pressures can be expected on small piers and lower effective pressures on larger piers. (See also W72-04521) (Knapp-USGS)
W72-04529

MOVEMENTS IN CONTINUOUS LAKE ICE SHEETS AND TEMPERATURE GRADIENTS IN AN ICE SHEET,
Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
S. S. Lazier, and F. A. MacLachlan.
In: Ice Engineering and Avalanche Forecasting and Control, Proceedings of Conference held at Calgary University, October 23-24, 1969; National Research Council of Canada Associate Committee of Geotechnical Research Technical Memorandum No 98, p 17-23, 1970. 8 fig, 1 tab, 9 ref.

Descriptors: *Lake ice, *Lake Ontario, *Data collections, Iced lakes, Ice jams, Ice breakup.
Identifiers: Kingston Harbour (Ontario).

Kingston Harbour, Lake Ontario, normally freezes over early in January each year and, within a couple of weeks, the ice is sufficiently strong to support light vehicles. Breakup usually occurs after the middle of March. A progress report is given on the observations made with respect to ice movements during three winter seasons and the measurements of thermal gradients through the ice sheet which were taken in 1969. The ice sheet is usually 2 to 3 miles in width and over five miles long extending toward the open lake. Normally the ice reaches a maximum thickness of something less than 2 feet. One of the interesting features of this ice sheet is the appearance of large pressure ridges. These may extend for several miles and grow to a height of 6 feet or more. The growth of pressure ridges and the movement of ice sheet is a function of the total heat transfer situation which occurs between ice and air, and ice and water. (See also W72-04521) (Knapp-USGS)
W72-04530

A TENTATIVE FIELD CLASSIFICATION OF LAKE AND RIVER ICE,
National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
G. P. Williams.
In: Ice Engineering and Avalanche Forecasting and Control, Proceedings of Conference held at Calgary University, October 23-24, 1969; National Research Council of Canada Associate Committee of Geotechnical Research Technical Memorandum No 98, p 5-11, 1970. 1 fig, 3 ref.

Descriptors: *Ice, *Lake ice, *Freezing, Frazil ice, Snow, Cryology, Iced lakes, Rivers, Lakes.
Identifiers: Ice classifications.

Field description of lake and river ice is based on the origin of the ice and how it develops and changes throughout the winter season. Ice covers are classified into two main divisions: static ice formed on lakes and rivers under relatively still water conditions; and dynamic ice formed in water with strong mixing by wind and currents. The observations needed to classify ice are listed. (See also W72-04521) (Knapp-USGS)
W72-04531

CLASSIFICATION OF RIVER AND LAKE ICE BASED ON ITS GENESIS, STRUCTURE AND TEXTURE,
Laval Univ., Quebec. Dept. of Civil Engineering.
B. Michel, and R. O. Ramseier.
In: Ice Engineering and Avalanche Forecasting and Control, Proceedings of Conference held at Calgary University, October 23-24, 1969; National Research Council of Canada Associate Committee of Geotechnical Research Technical Memorandum No 98, p 1-4, 1970. 1 ref.

Descriptors: *Ice, *Lake ice, *Freezing, Frazil ice, Snow, Cryology, Iced lakes, Rivers, Lakes.
Identifiers: Ice classifications.

Classification of river and lake ice has three main aspects: definition of river and lake ice terms in a natural genetic scheme; description of the formation and physical properties of the three important ice layers; and description of the textures ot the various ice types found in ice covers. There are two models of ice cover formation. The first one occurs in an undisturbed body of water such as a lake or river with laminar flow. Under these conditions, a solid continuous ice sheet is formed with a uniform structure in the horizontal plane. This ice sheet may originate from border ice or plate ice formed on the water body. In rivers where there is turbulent flow the formation is more dynamic and comes mainly from the accumulation of frazil slush, pancake ice and ice floes. Wind and wave action may also cause a similar process in lakes and coastal regions. Primary ice is the first type of ice of uniform structure and texture which forms on a water body. Secondary ice forms parallel to the heat flow, which is perpendicular to the primary ice. Snow ice always forms on top of the primary ice due to snow deposits which lie on the ice cover. (See also W72-04521) (Knapp-USGS)
W72-04532

DETERMINATION OF THE ACOUSTIC PROPERTIES OF FROZEN SOILS,
Cold Regions Research and Engineering Lab., Hanover, N.H.
Y. Nakano.
Technical Report, May, 1971.

Descriptors: *Frozen soils, *Acoustics, *Compressability, *Soil mechanics, Ultrasonics.
Identifiers: *Elastic waves, *Compression waves, *Viscoelasticity.

The acoustic properties of frozen earth materials were investigated. The study consists of four different efforts described in four sections. In the first part, the velocities of dilatational waves in sand, silt and clay specimens were measured with the pulse first-arrival technique. The 2.5 x 15 cm or 2.5 x 90 cm cylindrical specimens were fully saturated, then frozen. In the second part a linear visoelastic constitutive equation was obtained by the use of the resonance column technique. The equation describes the dynamic behavior of frozen soils under both torsional and longitudinal vibrations. In the third part the method of free oscillation of spherical specimens was developed, making possible the measurement of the elastic properties of solids and fluids, and, in particular, of frozen ground. In the last part the acoustic properties were determined by an ultrasonic technique using a critical angle tank.
W72-04550

ANNOTATED BIBLIOGRAPHY ON FRESHWATER ICE.
Lake Survey Center, Detroit, Mich.

NOAA Technical Memorandum NOS LSCR2, Lake Survey Center Report No. 2, September 1971, 425 p. DACR 35-68-C-0069.

Descriptors: *Limnology, *Lakes, *Fresh water, Ice, Rivers, Lake ice, Ice loads, Ice breakup, Ice jams, Frazil ice, Engineering structures.
Identifiers: *Ice modification techniques.

The bibliography lists over 2000 selected references pertaining to freshwater ice. A subject index and a geographic index make this body of information more accessible. The subject index divides the bibliography into engineering and research categories. Engineering entries constitute 30 percent of the total and include information on ice modification and control, engineering structures and technology, and navigation; scientific investigations on the formation, growth, and decay of freshwater ice constitute the research group. The geographic index is composed of approximately 47 percent of the abstracts. Of these, 13 percent identify studies in Antarctica, North America, and Greenland while 34 percent identify studies made in Europe and Asia. English language references account for approximately 34 percent of all abstracts. The bibliography was prepared by the Arctic Institute of North America.
W72-04585

HYBRID COMPUTER SIMULATION OF THE ACCUMULATION AND MELT PROCESSES IN A SNOWPACK,
Utah State Univ., Logan. Coll. of Engineering.
K. O. Eggleston, E. K. Israelsen, and J. P. Riley.
Utah Water Research Laboratory Report PRWG65-1, June 1971. 77 p, 71 fig, 2 tab, 44 ref, 2 append. ESSA E-268-68 (N).

Descriptors: *Snowpacks, *Snowmelt, *Water equivalent, Computer models, Systems analysis, Input-output analysis, Albedo, Density stratification, Water yield, Model studies, Radiation, Evaporation, Runoff.
Identifiers: Point snowmelt, Snowmelt modeling, Hybrid computer.

An investigation to develop an operational simulation model of the point snowmelt process based on a time increment of one day or less is described. Mathematical relationships for various phenomena involved in the snowmelt process were proposed and tested. These relationships were combined into a model which is applicable to any geographic location by determining appropriate constants for certain relationships. The model was synthesized on a hybrid computer and calibrated using field data from the Central Sierra Snow Laboratory. It was then tested with data from other well instrumented locations. Sensitivity tests were also conducted to study the relative effects of the various basic parameters and functions upon the melting process. (Woodard-USGS)
W72-04658

2D. Evaporation and Transpiration

EVAPORATION FROM LOWLAND VEGETATION IN THE NEW JERSEY PINE BARRENS,
Rutgers - the State Univ., New Brunswick, N.J. Dept. of Botany.
M. F. Buell, and J. T. Ballard.
Available from the National Technical Information Service as PB-206 428, $3.00 in paper copy, $0.95 in microfiche. New Jersey Water Resources Research Institute, New Brunswick, January 1972. 84 p, 32 fig, 5 tab, 24 ref, 3 append. OWRR B-006-NJ (3).

Descriptors: *Evapotranspiration, *Lysimeters, *Pheatophytes, *Water loss, Consumptive use, Evaporation, Microenvironment, Plants, Transpiration, New Jersey, Advection, *Shrubs, Trees, Pine trees, Hardwood.
Identifiers: Cedar.

Evapotranspiration from the three lowland vegetation communities (shrub, hardwood swamp, and cedar swamp) of the New Jersey pine barrens was measured by lysimeters in the shrub community, and analysis of the water table fluctuations in the tree community from meteorological data collected at the site. A simulation of the evapotranspiration-ground water system was developed to aid in the analysis of field data on water table fluctuations. The resistance to water flow through the evapotranspiration channel in the shrub community drops rapidly with leafing out in the spring, but remains above the resistance predicted by potential evaporation measurements. Differences in resistance among lysimeters is attributed to differences in shrub cover. No differences in evapotranspiration rates were detected among the tree communities, but they evapotranspired water at a rate two to three times that of the shrub community. Advection of heat energy from the relatively dry uplands supplemented the local source of evaporative energy resulting in high evapotranspiration rates for the lowland tree communities.
W72-04128

SOIL WATER EVAPORATION: LONG-TERM DRYING AS INFLUENCED BY SURFACE RESIDUE AND EVAPORATION POTENTIAL,
Agricultural Research Service, Mandan, N. Dak. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02G.
W72-04195

BOUNDARY CONDITIONS AND CONDUCTIVITIES USED IN THE ISOTHERMAL MODEL OF EVAPORATION FROM SOIL,
Department of Agriculture, Ottawa (Ontario). Soil Research Inst.
For primary bibliographic entry see Field 02G.
W72-04197

EVAPORATION FROM BARE SOIL AS AFFECTED BY TEXTURE AND TEMPERATURE,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W72-04199

ESTIMATION OF THE EFFECT OF SURFACE RUNOFF ON READINGS OF SOIL EVAPORATION PANS AND LYSIMETERS (OTSENKA VLIYANIYA POVERKHNOSTNOGO STOKA NA POKAZANIYA POCHVENNYKH ISPARITELEY I LIZIMETROV),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
A. S. Subbotin.
In: Sbornik rabot po gidrologii, No. 9; Gosudarstvennyy Gidrologicheskiy Institut, Leningrad, Gidrometeoizdat, p 200-210, 1970. 2 fig, 7 tab, 4 ref.

Descriptors: *Equipment, *Lysimeters, *Evaporation pans, *Evaporation, *Surface runoff, Water balance, Precipitation (Atmospheric), Antecedent precipitation, Rainfall-runoff relationships, Wetting, Excess water (Soils), Soil moisture, Moisture content, Crops, Plant growth, Slopes, Seasonal.
Identifiers: *European USSR, *Novgorod Oblast, *Leningrad Oblast, *Fallow, Monoliths.

Data obtained from runoff and water-balance plots in a zone of excess moisture at Valday Scientific Research Hydrological Laboratory (Novgorod Oblast) in 1947-64 and at Tosno (Leningrad Oblast) in 1934-40, and in a zone of deficient moisture at Dubovka (Rostov Oblast) in 1950-60 were used to study shower runoff from fields under fallow and various crops (potato, sugar beet, beans, corn, flax, oats, rye, and wheat). The results of runoff measurements directly from evaporation pans and lysimeters measuring 0.3 and 1.0 sq m are presented. An estimate is made of possible excess wetting of lysimeter core samples as a result of retained surface runoff and its effect on evaporation. It is concluded that surface runoff plays an insignificant role in lysimeter operation. (Josefson-USGS)
W72-04357

CHANGES IN THE ELEVATION OF GREAT SALT LAKE CAUSED BY MAN'S ACTIVITIES IN THE DRAINAGE BASIN,
Geological Survey, Salt Lake City, Utah.
For primary bibliographic entry see Field 04A.
W72-04370

AN ESTIMATE OF THE HEAT BALANCE OF A VALLEY AND HILL STATION IN CENTRAL ALASKA,
Alaska Univ., College. Geophysical Inst.
For primary bibliographic entry see Field 02C.
W72-04394

2E. Streamflow and Runoff

DEPLETIONS, LOSSES, AND GAINS ALONG THE PECOS RIVER FROM ALAMOGORDO DAM TO ACME GAGE, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
L. J. Reiland.
Geological Survey Open-file Report, August 1971. 110 p, 23 fig, 2 tab, 3 ref, 25 append.

Descriptors: *Water resources development, *Streamflow, *Water yield, *Water loss, New Mexico, Texas, Surface waters, Water users, Reservoirs, Water demand, Hydrologic budget, Stream gages, Flow rates, Regulated flow.
Identifiers: *Pecos River (N. Mex and Tex).

A hydrologic study of the Pecos River in New Mexico and Texas was made to (1) determine the net monthly depletion of flow in the Pecos River that can be attributed to the use of surface water on the Fort Sumner Project; (2) determine the net monthly loss in streamflow in the channel between Alamogordo Dam and the Acme gage, exclusive of the Fort Sumner Project depletion; (3) determine the net monthly inflow to the reach that passes the Acme gage; and (4) provide a means of estimating losses from future releases. The mean-annual depletion for the period 1938 through 1967 was 12,950 acre-feet per year. If an allowance of 15 percent is made for loss from distribution systems and drains, the consumptive use of diverted water would be 1.84 acre-feet per acre using a total water consuming area of 6,000 acres. The effective precipitation during the irrigation season adds an additional foot to make the consumptive use about 2.8 feet per acre. (Woodard-USGS)
W72-04201

WATER TEMPERATURES OF CALIFORNIA STREAMS, COLORADO DESERT SUBREGION,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 07C.
W72-04202

APPLICATION OF ANALOG COMPUTER FOR STREAMFLOW SYNTHESIS-PHASE I,
Nevada Univ., Reno. Center for Water Resources Research.
For primary bibliographic entry see Field 04A.
W72-04207

CHARACTERISTICS OF STREAMFLOW OF SMALL WATERSHEDS IN PENNSYLVANIA AND FACTORS THAT INFLUENCE IT,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
W. E. Sopper.
Available from the National Technical Information Service as PB-206 434, $3.00 in paper copy, $0.95 in microfiche. Completion Report, December 1971. 14 p, 18 ref. OWRR A-006-PA (14).

Descriptors: *Streamflow, *Watersheds, Runoff, *Water yield, *Low flow, *Pennsylvania, Flow.
Identifiers: *Flow-duration, Forest cover.

Four studies were conducted. The first was to determine average annual and seasonal water yields, flow duration, and high daily flows for 137 watersheds and to relate these, insofar as possible, to the seven major physiographic regions in the Northeast. In the second study, the relationships of average annual and seasonal discharges, flow-duration discharges, and high daily flow discharges to selected climatic, geographic, topographic, and land-use variables were investigated. This analysis was extended in the third study to better define the relationships between the water yield parameters and the climatic and physical watershed variables within each of the physiographic regions. The fourth study was concerned primarily with the determination of the representativeness of the small experimental watersheds in relation to the physiographic region in which they are located. All watersheds (137) in the Northeast that were less than 100 square miles in area, that had continuous streamflow records from 1940 to 1957 (17 years), and that were not appreciably affected by regulation and diversion were included in these studies.
W72-04287

STREAM TYPES IN THE DES MOINES RIVER BASIN,
Georgia Univ., Athens. Dept. of Geography.
R. A. Stephenson.
Water Resources Bulletin, Vol 7, No 6, p 1172-1179, December 1971. 2 fig, 2 tab, 9 ref. OWRR A-006-IA (2).

Descriptors: *Streams, *Iowa, *Channel morphology, *Glacial drift, Geomorphology, Statistics, Statistical methods, Probability, Topography, Terrain analysis.
Identifiers: Des Moines River Basin (Iowa).

Stream tributaries in the Des Moines River basin were classified according to the glacial terrain through which they flow. Three stream types were categorized as follows: (1) streams that flow entirely on Wisconsin drift, (2) streams that flow entirely on Kansan drift, and (3) streams that have their headwaters on new drift but have their lower reaches flowing on older drift. Selected channel and valley characteristics were measured and used to verify the stream type classification. Five variables were studied by multiple linear discriminatory analysis. Streams that do not fit the classification are associated with pre-glacial drainage or at least pre-Wisconsin age drainage. Otherwise, the major channels and valleys in the Des Moines River basin tend to reflect the glaciated upland surface. (Knapp-USGS)
W72-04327

THE NIAGARA RIVER PLUME, PART 1 - TEMPERATURE AND CURRENT STRUCTURE IN THE NIAGARA RIVER PLUME,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02H.
W72-04328

FLOOD OF JANUARY 1969 NEAR CARPINTERIA, CALIFORNIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04329

DETERMINATION OF FLOODFLOW OF THE SACRAMENTO RIVER AT BUTTE CITY, CALIFORNIA, JANUARY 1970,
Geological Survey, Menlo Park, Calif.
J. C. Blodgett, and V. F. Pearce.
Geological Survey Open-file Report, 1971. 29 p, 9 fig, 5 tab, 13 ref.

Descriptors: *Floodwater, *Flood plains, *Overflow, *Rainfall-runoff relationships, Levees, River beds, Gaging stations, Instrumentation, Methodology, Floods, Peak discharge, Stage-discharge relations, Channel morphology.
Identifiers: *Sacramento River (Calif), Butte City (Calif).

Floodflow conditions along the Sacramento River and in the overflow area in Butte Basin are described, with particular reference to the special work in 1970. The scope includes a description of methods and instrumentation that are being used to determine floodflows, and a summary of annual peak data from 1915 to 1970. Floodflow data at the latitude of Butte City during January 1970 indicate that a substantial part of the Sacramento River flow left the main channel and flowed through Butte Basin. One third of the peak flow of 225,000 cfs on January 24, 1970, was on the east-bank flood plain. Because of changing channel conditions and cultural development on the flood plain, flow characteristics defined in 1970 may not be applicable to past or future floods. A detailed map scaled one inch to the mile shows the drainage pattern, levees, cultural features, and gaging station sites. Cross sections show the water level in the river and overflow areas near Butte City, California. (Lang-USGS)
W72-04344

HYDROLOGY AND SEDIMENTATION OF COREY CREEK AND ELK RUN BASINS, NORTH-CENTRAL PENNSYLVANIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04A.
W72-04346

SUMMARY OF FLOODS IN THE UNITED STATES DURING 1966,
Geological Survey, Washington, D.C.
J. O. Rostvedt.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, Price 50 cents (Paper cover). Geological Survey Water-Supply Paper 1870-D, 1971. 99 p, 35 fig, 29 tab, 19 ref.

Descriptors: *Floods, *United States, *Streamflow, *Flood damage, *Flow rates, Stream gages, Runoff, Peak discharge, Precipitation (Atmospheric), Rainfall, Snowmelt, Flow measurement, Hydrologic data, Data collections.
Identifiers: *Floods (United States, 1966).

The four most destructive floods in the United States during 1966 occurred during March-April in the Red River of the North basin in northwestern Minnesota, during April-May in northeastern Texas, in August in east-central Nebraska, and in December in the Southwestern United States. In the Red River, unseasonally warm temperature caused rapid melting of a heavy snow cover, with water equivalent ranging from 5 to 7 inches, which covered the northern two-thirds of the basin. Peak discharges were maximum of record at three gaging sites having periods of record ranging from 20 to 30 years, and peak discharges exceeded 50-year floods at nine sites. Damage from the flood was estimated at $10 million. In the period April 22-29, from 20 to 26 inches of rain fell in part of the Sabine River basin in northeastern Texas. Flood damage was estimated at $12 million, and 25 persons lost their lives. Floods along the Loup River and its tributaries in east-central Nebraska caused record peak discharges at nearly all gaging stations in the flood area. Flood damage was estimated at $11 million. In early December a storm moved eastward from the Pacific coast in southern California into Southwestern United States. Discharges on many streams exceeded the previous maximums known, and the flood was particularly damaging because of the large area involved. (Woodard-USGS)
W72-04347

RUNOFF FROM SMALL CATCHMENTS IN THE CENTRAL RUSSIAN UPLAND (O STOKE S MALYKH VODOSBOROV SREDNERUSSKOY VOZVYSHENNOSTI),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
A. N. Popov.
In: Sbornik rabot po gidrologii, No. 9; Gosudarstvennyy Gidrologicheskiy Institut, Leningrad, Gidrometeoizdat, p 225-240, 1970. 3 fig, 5 tab, 17 ref.

Descriptors: *Runoff, *Runoff coefficient, *Watersheds (Basins), *Geomorphology, Discharge (Water), Sediment discharge, Ion transport, Streams, Ephemeral streams, Floods, Slopes, Thalweg, Forests, Ravines, Rainfall-runoff relationships, Water storage, Seasonal, Irrigation, Ponds, Maps.
Identifiers: *USSR, *Central Russian Upland, *Don River, *Sediment concentration, Mineralization.

Results of investigations of runoff from small catchments, based on observations by the Nizhnedevitsa Runoff Station (NRS), are presented. The Station is located in the center of the Central Chernozem Belt, in the Cretaceous physiographic region of the Don River area in the forest-steppe province of the Central Russian Upland. The experimental catchments are located in the upper part of the basin of the Devitsa River, a right tributary of the Don. The physiographic description of the area is accompanied by tables of principal annual and flood runoff characteristics, maps of long-term average annual and flood runoff (mm) of ephemeral streams in field catchments, and by tables showing sediment discharge during a flood in the Barsuk and Medvezhiy Ravines and annual ion runoff for small catchments of permanent and ephemeral streams in the NRS area. Local factors that affect runoff from field catchments are the channel slope and, in forested catchments, the forest. Long-term average sediment discharge during the flood period is 5.6 times higher in a field than in a forested catchment. Average annual ion runoff in a field catchment (Barsuk Ravine) is 9.4 times higher than in a forested catchment (Medvezhiy Ravine) for a normally wet year. Observations at NRS, as well as conclusions derived, can be used to solve problems associated with development of practical measures to regulate and utilize local runoff. The quantitative characteristics obtained from annual and flood runoff make it possible to expand water resources studies in the direction of utilizing local runoff for irrigation and for developing plans for future construction of ponds. (Josefson-USGS)
W72-04356

ESTIMATION OF THE EFFECT OF SURFACE RUNOFF ON READINGS OF SOIL EVAPORATION PANS AND LYSIMETERS (OTSENKA VLIYANIYA POVERKHNOSTNOGO STOKA NA POKAZANIYA POCHVENNYKH ISPARITELEY I LIZIMETROV),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02D.
W72-04357

ACCURACY OF DETERMINING AVERAGE VERTICAL VELOCITY (TOCHNOST' OPREDELENIYA SREDNEY NA VERTIKALI SKOROSTI),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 08B.
W72-04358

MULTIPLE LINEAR CORRELATION OF HYDROLOGIC FACTORS TO ESTIMATE MINIMUM FLOW (PRIMENENIYE MNOZHESTVENNOY LINEYNOY KORRELYATSII K OTSENKE FAKTOROV I RASCHETAM MINIMAL' NOGO STOKA),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 04A.
W72-04361

HYDROCHEMICAL AND HYDROLOGIC CRITERIA OF LOCAL RUNOFF (GIDROKHIMICHESKIYE I GIDROLOGICHESKIYE KRITERII MESTNOGO STOKA),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
P. P. Voronkov.
In: Sbornik rabot po gidrologii, No 9; Gosudarstvennyy Gidrologicheskiy Institut, Leningrad, Gidrometeoizdat, p 3-28, 1970. 6 fig, 2 tab, 14 ref.

Descriptors: *Water chemistry, *Water analysis, *Runoff, *Watersheds (Basins), Water balance, Salt balance, Chlorides, Sulfates, Bicarbonates, Ions, Saline soils, Soil water, Groundwater, Surface waters, Rainfall-runoff relationships, Infiltration, Floods, Low flow, Topography, Hydrographs.
Identifiers: *European USSR, Traveltime, Mineralization.

Hydrochemical and hydrologic features of local runoff waters in various natural zones of the European USSR are examined. Considering the chemical composition of the main genetic water categories in different soil layers, three principal types of catchments are identified: (1) catchments with soils weakly salinized by chlorides and sulfates in which waters of all genetic categories are only slightly mineralized and strongly bicarbonate with Ca (++) predominant among the cations; (2) catchments with a very saline soil with chloride and sulfate salinization; and (3) catchments with river waters distinctly bicarbonate during spring high-water periods and either chloride or sulfate during low-water periods. To study specific characteristics of local runoff, catchments must generally meet the following requirements: (1) total catchment area must have a uniform relief with no vertical zonality features; (2) individual phases of spring high-water periods must occur simultaneously in all parts of the catchment; (3) travel time of water to the gaging station from the farthest points of the catchment must not exceed half the time of development of the main phase of high-water periods; (4) soil of the catchment must be more or less uniform as regards chlorides and sulfates; (5) the catchment must be more or less uniform with respect to lithological composition of rocks and hydrogeologic conditions; and (6) the predominant vegetation must cover at least 75% of the catchment area. Adherence to these conditions will make it possible to detect the principal chemical characteristics of local runoff waters of an area. (Josefson-USGS)
W72-04362

ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN WISCONSIN,
Wisconsin Geological Survey, Madison.
For primary bibliographic entry see Field 04A.
W72-04380

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE HOUSTON, TEXAS METROPOLITAN AREA, 1969,
Geological Survey, Houston, Tex. Water Resources Div.
For primary bibliographic entry see Field 07C.
W72-04381

LOW-FREQUENCY PERIODICITIES IN PANAMA RAINFALL RUNOFF,
Sandia Lab., Albuquerque, N. Mex.
For primary bibliographic entry see Field 02B.
W72-04395

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS, VOLUME 3. UPPER MISSISSIPPI RIVER BASIN BELOW KEOKUK, IOWA.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04441

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 1. NORTH ATLANTIC SLOPE BASINS- VOL 3, BASINS FROM MARYLAND TO YORK RIVER.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04444

HYDROLOGIC RECORDS FOR VOLUSIA COUNTY, FLORIDA, 1970-71,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 07C.
W72-04514

WATER IN THE ECONOMY OF THE JACKSON PURCHASE REGION OF KENTUCKY,
Geological Survey, Louisville, Ky.
For primary bibliographic entry see Field 03E.
W72-04520

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR LITTLE ELM CREEK, TRINITY RIVER BASIN, TEXAS, 1969,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 07C.
W72-04534

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE SAN ANTONIO, TEXAS METROPOLITAN AREA, 1969,
Geological Survey, San Antonio, Tex.
For primary bibliographic entry see Field 07C.
W72-04535

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE BRYAN, TEXAS METROPOLITAN AREA, 1969,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 07C.
W72-04536

DATA GENERATING METHODS IN HYDROLOGY,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 07C.
W72-04538

ANALYSIS OF EPHEMERAL FLOW IN ARIDLANDS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
C. C. Kisiel, L. Duckstein, and M. M. Fogel.
Journal of the Hydraulics Division, ASCE, Vol 97, No HY10, p 1699-1717, October 1971. 6 fig, 2 tab, 34 ref. OWRR B-007-ARIZ (13).

Descriptors: *Aridlands, *Low flow, *Hydrology, *Distribution pattern, *Stochastic processes, *Time series analysis, Storm runoff, Riparian water loss, Estimating, Poisson ratio, Arizona.
Identifiers: *Rillito Creek (Ariz), Tucson (Ariz).

The purpose was to present recent results in the stochastic analysis of ephemeral flows in Tucson, Arizona, and propose a framework for future analyses of such data. Ephemeral flow in aridlands is characterized by the absence of base flow, special precipitation patterns, and scarcity of data. Duration of individual flow events is an important parameter for natural recharge of aquifers. Using a regional model of rainfall, a stochastic model of flow duration was developed for a stream near Tucson. The number of flow events per summer seemed to follow a Poisson distribution and in winter, a geometric distribution. In both cases, however, the flow duration per event followed a negative binomial distribution. Time series estimates of monthly streamflow of the Rillito Creek were given to illustrate the correlation between various months and the difficulty of interpreting such time-lumped data. It was found that the event-based analyses of streamflows as observed in nature were more informative than monthly and annual series. (Markell-Cornell)
W72-04636

TRIBUTARY TO THE INTRACOASTAL WATERWAY AT INTERSTATE HIGHWAY 10 NEAR PORT ALLEN, LOUISIANA,
Geological Survey, Baton Rouge, La.
For primary bibliographic entry see Field 08B.
W72-04659

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE DALLAS, TEXAS METROPOLITAN AREA, 1969,
Geological Survey, Fort Worth, Tex.
For primary bibliographic entry see Field 07C.
W72-04661

INDEX OF SURFACE WATER STATIONS IN TEXAS - OCTOBER 1971.
Geological Survey, Austin, Tex. Water Resources Div.
For primary bibliographic entry see Field 07C.
W72-04662

HYDROLOGIC CONDITIONS DURING 1969 IN DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, Fla. Water Resources Div.
J. E. Hull.
Geological Survey Open-file Report 71008, 1971. 50 p, 39 fig, 4 tab, 11 ref.

Descriptors: *Hydrologic data, *Surface waters, *Groundwater, *Florida, *Data collections, Streamflow, Water wells, Water yield, Water levels, Rainfall, Groundwater recharge, Canals, Water quality, Saline water intrusion, Hydrology, Water resources development.
Identifiers: *Dade County (Fla).

The general hydrologic conditions in Dade County, Florida for the 1969 water year (October 1, 1968 to September 30, 1969) are summarized in tables, graphs, and maps. The chief source of fresh groundwater in Dade County is the Biscayne aquifer--a highly permeable limestone and sandstone capable of yielding large quantities of water suitable for municipal, industrial, and agricultural uses. Water-table fluctuations were recorded continuously in 62 wells in order to determine the effectiveness of water-management installations. The water level in well S-18 in northeastern Dade County has been stabilized since completion of the canal system during the mid 1950's. During 1969 the U.S. Geological Survey maintained 46 surface-water gaging stations within the county to determine water levels and runoff. Snake Creek, Biscayne, Little River, Miami, Tamiami, and Snapper Creek Canals flow into Biscayne Bay. Their combined annual discharge represents an estimated 75 percent of the total eastward runoff from all Dade County canals. During the water year the combined average daily discharge of these six canals was 1,134 mgd. This compares with a 10-year average of 968 mgd. (Woodard-USGS)
W72-04670

LASER-VELOCITY METER,
Lund Univ. (Sweden). Div. of Hydraulics.
For primary bibliographic entry see Field 07B.
W72-04671

AN AUTOMATIC DIGITAL WATER LEVEL FOLLOWER,
Centre National de la Recherce Scientifque, Toulouse (France). Hydrulic Lab.
For primary bibliographic entry see Field 07B.
W72-04673

PROBLEMS OF ENGINEERING HYDROLOGY (VOPROSY INZHENERNOY GIDROLOGII).
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).

Gosudarstvennyy Gidrologicheskiy Institut Trudy, No 180; 1970. 300 p.

Descriptors: *Statistical methods, *Probability, *Estimating, *Sampling, *Parametric hydrology, Synthetic hydrology, Hydrologic aspects, Streamflow, Runoff, Flow rates, Water year, Hydrodynamics, Meteorology, Geographical regions, Gaging stations, Rivers, Variability, Fluctuation, Correlation analysis, Time series analysis.
Identifiers: *USSR, *Engineering hydrology, *Hydrologic analysis, Autocorrelation, Skewness.

This collection of 10 papers deals with various aspects of the engineering application of hydrology to the solution of water management problems. The titles of the papers are: (1) method of combined analysis of runoff observations in hydrologically similar basins; (2) estimation of probability distribution parameters by groups of correlated hydrologic series; (3) computation of storm-flood characteristics by combined analysis of observational data on a group of rivers; (4) relationships between estimates of probability distribution parameters of correlated dependent variables; (5) estimation of probability distribution parameters of annual streamflow in the USSR; (6) random errors in estimates of the ordinates for a probability distribution curve of runoff characteristics; (7) composition of gamma-correlated random values; (8) refinement of procedures for calculating the probability of water level fluctuations of closed water bodies; (9) hydrodynamics of flows with inhomogeneous density; and (10) patterns of succession of dry and wet years as a basis for computing streamflow regulation. The collection is intended to serve practicing scientists, hydrologists, and hydraulic engineers, as well as undergraduate and graduate students in the fields of hydrometeorology and hydraulic engineering. (See also W72-04679 thru W72-04684) (Josefson-USGS)
W72-04678

METHOD OF COMBINED ANALYSIS OF RUNOFF OBSERVATIONS IN HYDROLOGICALLY SIMILAR BASINS (O METODIKE SOVMESTNOGO ANALIZA NABLYUDENIY ZA STOKOM GIDROLOGICHESKI SKHODNYKH BASSEYNOV),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
S. N. Kritskiy, and M. F. Menkel'.
In: Voprosy inzhenernoy gidrologii; Gosudarstvennyy Gidrologicheskiy Institut Trudy, No 180, p 3-29, 1970. 1 fig, 13 ref.

Descriptors: *Statistical methods, *Probability, *Parametric hydrology, *Hydrologic aspects, *Runoff, Flow rates, Discharge (Water), Precipitation (Atmospheric), Floods, River basins, Meteorology, Hydrometry, Stochastic processes, Synthetic hydrology, Frequency analysis, Variability, Fluctuation, Heterogeneity, Homogeneity.
Identifiers: *USSR, *Hydrologic analysis, *Hydrologic computations, Distribution curves, Skewness.

Evaluation of rare hydrologic phenomena, particularly the height and frequency of floods and high water, is based not only on direct observations of the regime of a given watercourse, but also indirectly on centuries of human experience. A method is given for a combined analysis of observations of grouped hydrologic elements that can compensate for the lack of direct information, which is limited to the length of hydrometric or meteorological records. The analysis is based on the following initial arguments: (1) year-to-year runoff fluctuations obey definite probability distributions; (2) these distributions do not change significantly over the periods for which hydrologic computations are made; and (3) runoff fluctuations of basins analyzed together are statistically independent, at least partially. The aim of the method examined is to detect the probability patterns that are common to many elements, despite the differences which remain between them after the relationships available in modern hydrology are used. The runoff characteristics of each basin of a group under study differ from those of other basins in two ways, the first being the incomplete synchronism of fluctuations of meteorological factors in each basin, and the second, the differences in the landscape and climate of the catchments, which produces a geographic component of variability. Procedures are outlined for combined analysis of incompletely homogeneous hydrologic characteristics, including investigation of the parameters of the probability distribution of hydrologic quantities. The results of combined analysis of observations of groups of analagous elements should be regarded as a source of information supplementing direct observations of each individual element. (See also W72-04678) (Josefson-USGS)
W72-04679

ESTIMATION OF PROBABILITY DISTRIBUTION PARAMETERS BY GROUPS OF CORRELATED HYDROLOGIC SERIES (OB OTSENKE PARAMETROV RASPREDELENIYA VEROYATNOSTEY PO GRUPPAM KORRELYATIVNO SVYAZANNYKH GIDROLOGICHESKIKH RYADOV),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
S. N. Kritskiy, and M. F. Menkel'.
In: Voprosy inzhenernoy gidrologii; Gosudarstvennyy Gidrologicheskiy Institut Trudy, No 180, p 30-49, 1970. 10 ref.

Descriptors: *Statistical methods, *Probability, *Estimating, *Parametric hydrology, *Hydrologic aspects, Sampling, Stochastic processes, Synthetic hydrology, Model studies, Correlation analysis, Regression analysis.
Identifiers: *USSR, *Hydrologic analysis, Skewness.

Methods are presented for finding the theoretical distributions of probability characteristics, estimated by groups of correlated hydrologic series. These methods are necessary for estimating the random component of variation of the hydrologic quantities examined. The text is divided into 4 sections: (1) statistical tests; (2) analytical computation of the random component of variation of estimates in correlations between elements in a set; (3) estimate of the mathematical expectation of random values for a group of correlated sample values; and (4) estimate of the variance of correlated values, whose solution is used in the investigations examined in the preceding sections. (See also W72-04678) (Josefson-USGS)
W72-04680

COMPUTATION OF STORM-FLOOD CHARACTERISTICS BY COMBINED ANALYSIS OF OBSERVATIONAL DATA ON A GROUP OF RIVERS (K RASCHETU KHARAKTERISTIK DOZHDEVYKH PAVODKOV PUTEM SOVMESTNOGO ANALIZA DANNYKH NABLYUDENIY PO GRUPPE REK),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
L. F. Sotnikova.
In: Voprosy inzhenernoy gidrologii; Gosudarstvennyy Gidrologicheskiy Institut Trudy, No 180, p 50-70, 1970. 10 fig, 5 tab, 12 ref.

Descriptors: *Statistical methods, *Probability, *Parametric hydrology, *Hydrologic aspects, *Storm runoff, Floods, Discharge (Water), Precipitation (Atmospheric), Gaging stations, Rivers, Watersheds (Basins), Estimating, Sampling, Variability.
Identifiers: *USSR, *Ukraine, *Dnieper River, *Hydrologic analysis.

Sample computations by combined analysis of meteorological and hydrologic characteristics of storm floods in the Middle Dnieper River basin of the Ukraine are examined. The empirical data used in the computations are based on observations at 10 meteorological stations and on 7 rivers and are divided into 2 parts. The first part includes records of daily precipitation maxima, which can be regarded as belonging to a normal probability distribution. The second part of the computations includes a combined analysis of records of maximum storm floods with a different probability distribution for individual rivers. A group analysis of the observations will make it possible to obtain more reliable characteristics of storm floods with a low probability of being exceeded. (See also W72-04678) (Josefson-USGS)
W72-04681

RELATIONSHIPS BETWEEN ESTIMATES OF PROBABILITY DISTRIBUTION PARAMETERS OF CORRELATED DEPENDENT VARIABLES (O SVYAZYAKH MEZHDU OTSENKAMI PARAMETROV RASPREDELENIYA VEROYATNOSTEY KORRELYATIVNO ZAVISIMYKH VELICHIN),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
Ye. G. Blokhinov.
In: Voprosy inzhenernoy gidrologii; Gosudarstvennyy Gidrologicheskiy Institut Trudy, No 180, p 71-84, 1970. 1 tab, 9 ref.

Descriptors: *Statistical methods, *Probability, *Correlation analysis, *Estimating, *Parametric hydrology, Water level fluctuations, Variability, Sampling, Equations, Rivers.
Identifiers: *USSR, *Hydrologic analysis, Skewness.

Correlation coefficients between statistical estimates of the distribution parameters of two correlated dependent variables are determined. Samples from a two-dimensional normal population with correlation coefficients other than zero and samples from a two-dimensional gamma-correlated population are studied. The correlation coefficients of two functions of sample values of one quantity and of sample values of a second quantity are expressed in terms of the correlation coefficient R between the two quantities and their parameters. The statement of this problem is related to the formulation of a method for a combined analysis of observations on a group of rivers whose water level fluctuations are synchronous from year to year. By knowing the correlation coefficients between the estimates of these parameters, as well as the coefficients of variation, skewness, etc., it is possible to compare the variance of their estimates, observed in a group of hydrologic basins, with that theoretically corresponding to the hypothesis of their membership in a normal probability distribution. (See also W72-04678) (Josefson-USGS)
W72-04682

ESTIMATION OF PROBABILITY DISTRIBUTION PARAMETERS OF ANNUAL STREAMFLOW IN THE USSR (OB OTSENKE PARAMETROV RASPREDELENIYA VEROYATNOSTEY GODOVOGO STOKA REK SSSR),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
Ye. G. Blokhinov, and L. F. Sotnikova.
In: Voprosy inzhenernoy gidrologii; Gosudarstvennyy Gidrologicheskiy Institut Trudy, No 180, p 85-123, 1970. 10 fig, 9 tab, 12 ref.

Descriptors: *Statistical methods, *Probability, *Estimating, *Parametric hydrology, *Streamflow, Flow rates, Regulation, Discharge (Water), Water yield, Gaging stations, Rivers, Reservoirs, Sampling, Variability, Fluctuation.
Identifiers: *European USSR, *Kazakhstan, Skewness.

A brief description is given of long-term streamflow records at 120 gaging stations in the northern and temperate zones of the European USSR and in the steppe region of Kazakhstan. The length of record at gaging stations in the European USSR is 40 years or more. For Kazakhstan the records required were reduced to 25-30 years or more to achieve fuller coverage of the area. The values of the probability distribution parameters of annual streamflow, i.e., the coefficients of variation and skewness, computed by various methods, were compared. The problem of estimating the coefficient of skewness in annual flow computations was examined. A sample computation of annual flow is given, based on a combined analysis of observational data for 8 rivers in the dry region of Kazakhstan. (See also W72-04678) (Josefson-USGS)
W72-04683

PATTERNS OF SUCCESSION OF DRY AND WET YEARS AS A BASIS FOR COMPUTING STREAMFLOW REGULATION (ZAKONOMERNOSTI CHEREDOVANIYA MALOVODNYKH I MNOGOVODNYKH LET KAK OSNOVA RASCHETOV REGULIROVANIYA RECHNOGO STOKA),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
D. Ya. Ratkovich.
In: Voprosy inzhenernoy gidrologii; Gosudarstvennyy Gidrologichskiy Institut Trudy, No 180, p 179-293, 1970. 26 fig, 22 tab, 39 ref, append.

Descriptors: *Statistical methods, *Probability, *Parametric hydrology, *Synthetic hydrology, *Streamflow, Regulation, Fluctuation, Flow rates, Surface runoff, Subsurface flow, Precipitation (Atmospheric), Evaporation, Moisture content, Reservoir storage, Geographical regions, Gaging stations, Rivers, Correlation analysis, Time series analysis, Sampling.
Identifiers: *USSR, Europe, North America, Asia, Australia, Africa.

This article is a continuation of articles with the same title published earlier by the author in Nos. 143, 160 and 162 of the Transactions of the State Hydrologic Institute and is devoted to a study of the patterns of annual streamflow fluctuations, based on long-term observations at 339 gaging stations on 289 rivers of the world. Areal density of the stations by continent is as follows: Europe--151; North America--142; Asia--31; Australia--11; and Africa--4. The initial premise of the study is that the main structural elements of flow series are groups of dry and wet years. The distribution and magnitude of wet and dry years determine the long-term component of the reservoir storage needed to ensure a desired yield. A time-series analysis is made of annual streamflow, surface and subsurface flow, precipitation, and the factors which determine evaporation. Temporal patterns of succession of years of different wetness are examined from the standpoint of their effect on the probability patterns of annual flow fluctuations. Distributions of the duration of groups of dry and wet years are presented in conjunction with stochastic relationships between the wetness of a year and its position in the group. On the basis of these probability patterns, annual flow series cannot be regarded as successions of independent random values; qualitatively, these patterns are the same as those in distributions of positively correlated random values. Autocorrelation is not the same on all rivers; it increases most noticeably with decreasing flow rate. The system of standard relationships presented makes it possible to select a mathematical model which will reflect as fully as possible the probability patterns of annual streamflow fluctuations. (See also W72-04678) (Josefson-USGS)
W72-04684

2F. Groundwater

A FINITE DIFFERENCE METHOD FOR UNSTEADY FLOW IN VARIABLY SATURATED POROUS MEDIA: APPLICATION TO A SINGLE PUMPING WELL,
Nevada Univ., Reno. Center for Water Resources Research.
R. L. Cooley.
Water Resources Research, Vol 7, No 6, p 1607-1625, December 1971. 11 fig, 29 ref. OWRR A-013-PA.

Descriptors: *Unsteady flow, *Saturated flow, *Unsaturated flow, *Numerical analysis, Simulation analysis, Computer programs, Water table, Drawdown, Water yield, Water wells, Porous media.

Finite difference equations were derived by using the divergence theorem to convert the nonlinear partial differential equation (which approximately describes liquid flow in a variably saturated, elastic porous medium) to an integral equation, and then to integrate around individual mesh volume elements. Originial nonlinearity of the differential equation was preserved by keeping satu-

rations and relative conductivities current with hydraulic heads during the iterative matrix solution method. The problem of axisymmetric flow to a water well that penetrates one or more elastic rock units, the upper one of which is unconfined, provides a convenient vehicle for analysis of the procedural and theoretical study of unconfined and semiconfined flow. Of the three methods tried to solve the matrix equation that resulted from the finite difference equations (which included a form of the direct alternating direction implicit method, the iterative alternating direction implicit method, and the line successive overrelaxation method), the line successive overrelaxation method was the fastest and was selected for use in a general computer program. A comparison with analytical solutions that use Boulton's convolution integral as a velocity boundary condition at the water table for a single aquifer and an aquifer-aquitard system demonstrates close correspondence of the numerical and analytical solutions, even for a case where the water table is lowered appreciably. (Knapp-USGS)
W72-04163

GROUND-WATER RESOURCE OF THE BLUE GULCH AREA IN EASTERN OWYHEE AND WESTERN TWIN FALLS COUNTIES, IDAHO,
Idaho Dept. of Water Administration, Boise.
For primary bibliographic entry see Field 04B.
W72-04175

CHANGE IN GROUND WATER U234/U238 ISOTOPIC RATIO AFTER TASHKENT EARTHQUAKE,
For primary bibliographic entry see Field 02K.
W72-04200

APPLICATION OF BOREHOLE GEOPHYSICS TO WATER-RESOURCES INVESTIGATIONS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04B.
W72-04203

GEOHYDROLOGY OF THE PICEANCE CREEK STRUCTURAL BASIN BETWEEN THE WHITE AND COLORADO RIVERS, NORTHWESTERN COLORADO,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04330

GEOLOGY OF THE COMPACTING DEPOSITS IN THE LOS BANOS-KETTLEMAN CITY SUBSIDENCE AREA, CALIFORNIA,
Geological Survey, Washington, D.C.
R. E. Miller, J. H. Green, and G. H. Davis.
Available from GPO, Washington, D C 20402 - $2.25 (paper cover). Geological Survey Professional Paper 497-E, 1971. 46 p, 15 fig, 5 plate, 3 tab, 63 ref.

Descriptors: *Land subsidence, *Groundwater, *Withdrawal, *Geology, *California, Pumping, Water wells, Drawdown, Water table, Water users, Geomorphology, Elevation, Hydrogeology, Irrigation, Aquifers, Aquifer characteristics, Groundwater movement.
Identifiers: *Los Banos-Kettleman (Calif).

The Los Banos-Kettleman City area includes 1,500 square miles on the central west side of the San Joaquin Valley, Calif., chiefly in western Fresno County. It is an agricultural area, irrigated chiefly by groundwater. Intensive pumping has lowered the artesian head several hundred feet and has caused the water-bearing deposits to compact. By 1959 the resulting regional subsidence of the land surface exceeded 4 feet in most of the area and locally attained 20 feet. Superimposed on this regional subsidence was as much as 10-15 feet of localized subsidence due to hydrocompaction of moisture-deficient near-surface deposits, which affected at least 80 square miles. This is the largest known area of intensive land subsidence due to withdrawal of groundwater. The geology of the compacting deposits, including source, type, physical character, and thickness, is discussed in appraising the response of the sediments to change in effective stress. (Woodard-USGS)
W72-04331

GEOLOGY, HYDROLOGY, AND QUALITY OF WATER IN THE MADERA AREA, SAN JOAQUIN VALLEY,
Geological Survey, Menlo Park, Calif. Water Resources Div.
H. T. Mitten, R. A. LeBlanc, and G. L. Bertoldi.
Geological Survey Open-file Report, March 6, 1970. 49 p, 18 fig, 3 plate, 17 tab, 60 ref.

Descriptors: *Water resources development, *Groundwater, *Surface waters, *Hydrologic data, *California, Water yield, Water quality, Chemical analysis, Aquifers, Aquifer characteristics, Data collections, Water supply, Streamflow, Water wells, Water users, Water level fluctuations.
Identifiers: *San Joaquin Valley (Calif), Madera Area (Calif).

The Madera, California area includes about 870 square miles of flat to rolling semiarid agricultural land lying west of the foothills of the Sierra Nevada and east of the trough of the San Joaquin Valley. Because only 1 to 2 percent of the annual mean precipitation of about 10 inches falls during the hot summer and 70 to 75 percent falls during the mild winter, agriculture in the area, during the growing season, depends largely on irrigation water from both stream diversion and wells. The San Joaquin River, which is perennial, and the Fresno and Chowchilla Rivers, which are intermittent, are the principal streams. Geologic units in the area consist of consolidated rocks and unconsolidated deposits. The most important aquifer in the area is the older alluvium. It consists mostly of intercalated lenses of clay, silt, sand, and some gravel. Yields to wells in the older alluvium range from 40 to 4,750 gpm. Most of the fresh groundwater is a bicarbonate type that contains dissolved solids of less than 500 mg/liter. In the western part larger concentrations in sodium and chloride increase the dissolved solids. (Woodard-USGS)
W72-04334

GROUND WATER IN SANTA BARBARA AND SOUTHERN SAN LUIS OBISPO COUNTIES, CALIFORNIA, SPRING 1968 TO SPRING 1969,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 04B.
W72-04339

GROUND-WATER RESOURCES OF MONTGOMERY COUNTY, PENNSYLVANIA,
Geological Survey, Washington, D.C. Water Resources Div.
T. G. Newport.
Available from Bureau of Publications, P.O. Box 1365, Harrisburg, Penn. 17125. Pennsylvania Geological Survey, 4th Ser, Bulletin W-29, 1971. 83 p, 14 fig, 2 plate, 7 tab, 18 ref.

Descriptors: *Groundwater, *Water wells, *Hydrologic data, *Hydrogeology, *Pennsylvania, Data collections, Water yield, Water quality, Chemical analysis, Aquifer characteristics, Petrography, Water users, Water levels, Water supply, Groundwater recharge, Water resources development.
Identifiers: *Montgomery County (Pa.).

Data are tabulated for more than 800 wells in Montgomery County, Pa. The bedrock formations range in age from Quaternary to Precambrian. Groundwater in the bedrock occurs largely in secondary openings, such as joint planes or solution openings. These secondary openings are abundant in the Brunswick and Stockton Formations and wells in these formations yield sufficient water for industrial and municipal supplies. Groundwater in the Triassic rocks largely contains calcium bicarbonate. However, water from these rocks having concentrations of dissolved solids greater than 500 mg/l contains calcium sulfate. Groundwater quality differs greatly from one unit to another in the Paleozoic rocks. Dissolved-solids content ranges from 32 mg/l in the quartzites to 243 mg/l in the carbonate rocks. Hardness ranges from 15 mg/l in the quartzites to 270 mg/l in the carbonates. The quality of water from the igneous rocks is generally good. The quality of water from metamorphic rocks differs considerably between formations. In some of these rocks the water is very highly mineralized and is not used. (Woodard-USGS)
W72-04345

BASE FLOW AS AN INDICATOR OF AQUIFER CHARACTERISTICS IN THE COASTAL PLAIN OF DELAWARE,
Geological Survey, Dover, Del.
R. H. Johnston.
Available from GPO, Washington, DC 20402 Price $2.50. Geological Survey Research 1971, Chapter D, Professional Paper 750-D, p D212-D215, 1971. 1 fig, 1 tab, 16 ref.

Descriptors: *Base flow, *Aquifer characteristics, *Delaware, *Diffusivity, *Surface-groundwater relationships, Rainfall-runoff relationships, Discharge (Water), Groundwater basins, Coastal plains, Transmissivity.

Base flow constitutes 75-90% of the streamflow in the Coastal Plain of central and southern Delaware. In several small basins, a correlation is established between base flow and the hydraulic diffusivity of the water-table aquifer. Small basins of high hydraulic diffusivity drain rapidly during the period of groundwater recharge (winter and early spring) and are characterized by above-average winter base flow. On the other hand, above-average base flow after prolonged periods of no recharge does not indicate high hydraulic diffusivity. In fact, small basins where the diffusivity is high may have lower discharge after extended dry periods than do basins where the diffusivity is lower. (Knapp-USGS)
W72-04365

COASTAL GROUND-WATER FLOW NEAR PONCE, PUERTO RICO,
Geological Survey of Puerto Rico, San Juan.
G. D. Bennett, and E. V. Giusti.
Available from GPO, Washington, DC 20402, Price $2.50. Geological Survey Research 1971, Chapter D, Professional Paper 750-D, p D206-D211, 1971. 5 fig, 4 ref.

Descriptors: *Groundwater movement, *Puerto Rico, *Analog models, Permeability, Alluvium, Hydrogeology, Sands, Gravels, Saline water intrusion, Coastal plains, Saline water-freshwater interfaces.
Identifiers: Ponce (Puerto Rico).

Electric-analog techniques were used to simulate groundwater flow in the alluvium on the south coast of Puerto Rico near Ponce. The flow simulations were taken in a vertical plane, using analog models made of conducting paper. Anisotropy was simulated by distortion of the coordinates, and the fresh-water--sea-water interface was determined by trial and error cutting of the model. Models having an anisotropy, or ratio of lateral to vertical permeability, of 1,000 gave results that agreed well with field conditions. Two simulations were performed--one corresponding to high water-table conditions and one corresponding to low water-table conditions. The flow pattern in the aquifer oscillates seasonaly between these two extremes, giving rise to a wide transition zone between fresh water and sea water. (Knapp-USGS)
W72-04366

RAISED BEACH DEPOSITS AND THEIR GROUND-WATER POTENTIAL IN THE SOUTHERN PART OF THE METLAKATLA PENINSULA, ANNETTE ISLAND, ALASKA,
Geological Survey, Oklahoma City, Okla.
M. V. Marcher.
Available from GPO, Washington, DC 20402, Price $2.50. Geological Survey Research 1974, Chapter D, Professional Paper 750-D, p D202-D205, 1971. 2 fig, 1 tab, 9 ref.

Descriptors: *Aquifers, *Beaches, *Alaska, Groundwater, Water supply, Hydrogeology, Sands, Gravels, Stratigraphy.
Identifiers: Annette Island (Alaska).

Interbedded layers of gravel and sand on the Metlakatla Peninsula, Annette Island, Alaska, are raised beach deposits largely from marine, glaciomarine, and glacial deposits reworked by waves and tidal currents. Such deposits and similar deposits elsewhere in southeastern Alaska may be potential sources of small groundwater supplies. (Knapp-USGS)
W72-04367

RECONNAISSANCE OF GROUND-WATER SUPPLIES FROM BEDROCK IN THE METLAKATLA PENINSULA, ANNETTE ISLAND, ALASKA,
Geological Survey, Oklahoma City, Okla.
M. V. Marcher.
Available from GPO, Washington, DC 20402, Price $2.50. Geological Survey Research 1971, Chapter D, Professional Paper 750-D, p D198-D201, 1971. 4 fig, 1 tab, 4 ref.

Descriptors: *Groundwater, *Alaska, *Hydrogeology, Water supply, Water yield, Aquifer characteristics, Transmissivity, Joints (Geology), Fractures (Geology), Water wells, Investigations, Water quality, Drawdown, Saline water intrusion.
Identifiers: Annette Island (Alaska), Aquifer testing.

Bedrock in the western part of Metlakatla Peninsula, Annette Island, Alaska, consists of igneous and metamorphic rocks that yield water only from fractures. A test well, 362 feet deep, obtained water between 305 and 362 feet. Initial production of the well was 100 gpm, but a 12-hour recovery test suggested that this rate probably could not be maintained because of hydrologic boundaries. When the well was pumped continuously at a rate of 35 gpm for more than 3 months, the water level declined 125 feet at an average rate of 0.6 foot per day to about 115 feet below sea level. Groundwater is a sodium bicarbonate type. During pumping of the test well, the chloride content of the water increased from 75 to 222 mg/liter indicating that salt water was entering the aquifer. (Knapp-USGS)
W72-04368

RESISTIVITY AND NEUTRON LOGGING IN SILURIAN DOLOMITE OF NORTHWEST OHIO,
Geological Survey, Denver, Colo.
L. M. MacCary.
Available from GPO, Washington, DC 20402, Price $2.50. Geological Survey Research 1971, Chapter D, Professional Paper 750-D, p D190-D197, 1971. 6 fig, 1 tab, 17 ref.

Descriptors: *Dolomite, *Ohio, *Electrical well logging, *Radioactivity techniques, Resistivity, Nuclear moisture meters, Hydrogeology, Porosity, Water quality, Aquifers, Permeability, Aquifer characteristics.
Identifiers: Neutron logging, Lockport Dolomite (Ohio).

Data from resistivity and neutron logs of the Lockport Dolomite in northwest Ohio may be used in a semiquantitative empirical manner to estimate water quality and formation porosity if sufficient supporting data are available. Zones in the dolomite that appear to function like cemented granular aquifers can be analyzed for water quality and porosity on the basis of log response. The method is empirical, but when applied to carbonate aquifers meeting the specified criteria, meaningful results are obtained. No useful relationships between formation factor and permeability can be established for the Lockport Dolomite owing to the great range in its estimated porosity. (Knapp-USGS)
W72-04369

RELATION BETWEEN OXIDATION POTENTIAL AND THE OCCURRENCE OF IRON IN GROUNDWATER FROM THE CHICOT AQUIFER, LAFAYETTE, LOUISIANA,
Geological Survey, Baton Rouge, La.
For primary bibliographic entry see Field 02K.
W72-04371

STRUCTURAL CHARACTERISTICS OF GRANULAR POROUS MEDIA,
Instituto Mexicano del Petroleo, Mexico City.
For primary bibliographic entry see Field 08D.
W72-04385

RESULTS OF SUBSURFACE EXPLORATION IN THE MID-ISLAND AREA OF WESTERN SUFFOLK COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
For primary bibliographic entry see Field 04B.
W72-04401

HYDROLOGIC CONTAMINATION PREDICTION METHODOLOGY,
Teledyne Isotopes, Palo Alto, Calif. Palo Alto Labs.
For primary bibliographic entry see Field 05B.
W72-04453

GROUND-WATER RESOURCES OF CHAMBERS AND JEFFERSON COUNTIES, TEXAS,
Geological Survey, Houston, Tex.
J. B. Wesselman, and S. Aronow.
Texas Water Development Board, Austin, Texas, Report 133, August 1971. 183 p, 28 fig, 7 tab, 78 ref.

Descriptors: *Water resources development, *Groundwater, *Water wells, *Hydrology, *Texas, Aquifers, Aquifer characteristics, Water yield, Water quality, Chemical analysis, Water supply, Water analysis, Hydrologic data, Data collections, Water levels, Logging (Recording), Withdrawal, Groundwater recharge, Water users, Hydrologic budget.
Identifiers: *Chambers County (Tex), Jefferson County (Tex).

The hydrologic units of Chambers and Jefferson Counties, Texas, the Chicot and Evangeline aquifers, and the Burkeville aquiclude are composed of gravel, sand, silt, and clay of Miocene, Pliocene, Pleistocene, and Holocene age. In 1965, total pumpage of fresh water was approximately 6.1 mgd. About 2.5 mgd was slightly or moderately saline water. Industrial use of groundwater was approximately 9 mgd, of which 4 mgd was imported. Municipal use of groundwater was approximately 8 mgd, of which 6 mgd was imported from Hardin County by the city of Beaumont. Irrigation use was approximately 1.5 mgd. Use of groundwater for irrigation will remain small because most of the available water is too saline. Aquifer tests were made in 22 wells. Coefficients of permeability ranged from 108 to 1,670 gpd per square foot. Water levels have declined generally in both counties. The largest decline is due to pumping in adjacent Harris County. The maximum decline was estimated at 150 feet. (Woodard-USGS)
W72-04517

GROUND-WATER RESOURCES OF CASS AND MARION COUNTIES, TEXAS,
Geological Survey, Austin, Tex.
M. E. Broom.
Texas Water Development Board, Austin, Texas, Report 135, October 1971. 66 p, 12 fig, 9 tab, 29 ref.

Descriptors: *Water resources development, *Groundwater, *Water wells, *Hydrologic data, *Texas, Data collections, Water yield, Water quality, Drawdown, Water users, Groundwater recharge, Hydrogeology, Aquifers, Aquifer characteristics, Water levels, Chemical analysis.
Identifiers: *Groundwater resources, Cass County (Tex), Marion County (Tex).

Cass and Marion Counties, an area of 1,325 square miles in northeast Texas, are underlain by the Cypress aquifer which is composed of the Wilcox Group, Carrizo Sand, Reklaw Formation, and Queen City Sand, all of Eocene age. These geologic units are hydraulically interconnected and function as a single aquifer. As a result of groundwater development, water levels in the artesian section of the aquifer have declined as much as 109 feet since 1964. Three areas in Cass and Marion Counties have been affected by pumping, but elsewhere in the report area, water levels show no appreciable change. Pumpage of groundwater in 1967 was 3.6 mgd or about 4,000 acre-feet. About 90 million acre-feet of fresh to slightly saline water is stored in the Cypress aquifer. Of that amount, 50 million acre-feet is available within 400 feet of the land surface. In areas where saturated sands are more than 400 feet thick, wells yield 500 or more gpm. (Woodard-USGS)
W72-04518

DATA FOR WELLS IN THE MODESTO--MERCED AREA, SAN JOAQUIN VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 04B.
W72-04519

THE PHYSICS OF FINE-PARTICLE MOVEMENT THROUGH PERMEABLE AQUIFERS,
Westinghouse Electric Corp., Pittsburgh, Pa.
For primary bibliographic entry see Field 05B.
W72-04537

USING EXPERIMENTAL MODELS TO GUIDE DATA GATHERING,
General Electric Co., Santa Barbara, Calif. TEMPO.
For primary bibliographic entry see Field 07B.
W72-04578

MATHEMATICAL ANALYSIS OF GROUNDWATER RECHARGE,
Arizona Univ., Tucson. Dept. of Agricultural Engineering.
W. G. Matlock.
Transactions of the American Society of Agricultural Engineers, Vol 13, No 6, p 785-787, 791, 1970. 5 fig, 1 tab, 10 ref. OWRR A-017-ARIZ (2).

Descriptors: *Groundwater recharge, *Mathematical model, *Ephemeral streams, *Arizona, Groundwater movement, Aquifer characteristics, Natural recharge, Hydrogeology, Hydrology, Water level fluctuations, Snowmelt.
Identifiers: *Rillito Creek Basin (Ariz).

The rise of groundwater levels caused by recharge from Rillito Creek in Arizona is described by a mathematical model. Rillito Creek is an ephemeral stream with a total drainage area of 918 square miles in the semiarid part of southern Arizona. The system is unique because of the dual nature of the flows it carries. Of the total drainage area, 183 square miles are mountainous, 40 square miles of which are above 6,000 ft. At this elevation ap-

preciable snowfall occurs each winter in all but the driest years. Consequently, considerable runoff from snow melt reaches Rillito Creek. The clear flow from snow melt infiltrates rapidly, seldom leaving the drainage area. On the other hand, summer floods following intense thunderstorms are more violent and of shorter duration. (Woodward-USGS)
W72-04652

HYDROLOGIC CONDITIONS DURING 1969 IN DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, Fla. Water Resources Div.
For primary bibliographic entry see Field 02E.
W72-04670

APPLICATION OF VARIATIONAL PRINCIPLE FOR THE SOLUTION OF THE GRAVITY DRAINAGE PROBLEM,
Regional Inst. of Tech., Jamshedpur (India). Dept. of Applied Mechanics.
For primary bibliographic entry see Field 02G.
W72-04674

UNCONFINED FLOW AROUND INCLINED SHEET PILES,
Indian Inst. of Science, Bangalore. Dept. of Civil and Hydraulic Engineering.
For primary bibliographic entry see Field 08B.
W72-04675

NONEQUILIBRIUM URANIUM IN GROUNDWATERS OF THE TASHKENT ARTESIAN BASIN (NERAVNOVESNYY URAN V PODZEMNYKH VODAKH PRITASHKENTSKOGO ARTEZIANSKOGO BASSEYNA),
Hydrogeology and Engineering Geology, Tashkent (USSR).
A. N. Sultankhodzhayev, A. I. Spiridonov, V. G. Tyminskiy, and R. N. Taneyev.
Uzbekskiy Geologicheskiy Zhurnal, No 3, p 75-77, 1970. 2 fig, 7 ref.

Descriptors: *Hydrogeology, *Groundwater, *Groundwater basins, *Uranium radioisotopes, Radioisotopes, Tracers, Deuterium, Infiltration, Flow, Hydrodynamics.
Identifiers: *USSR, *Uzbek SSR, *Uranium, *Artesian basins, Water migration.

Twenty-two samples of isotopic ratios of uranium (U234/U238) in groundwaters of the Tashkent artesian basin are examined. On the basis of measurements, the basin can be divided into three zones, which differ in the average U234/U238 value: I--infiltration zone; II--transitional zone; and III--deep circulation zone. Zone I, which includes the contributing area and adjacent regions, has a relatively high U234/U238 ratio (2.0-2.5), averaging 2.1. Average deuterium concentration in the waters of this zone is 0.93. Zone II is confined to the marginal part of the basin and has a U234/U238 ratio in the waters ranging from 2.6 to 1.3 and averaging 1.9. Average deuterium concentration is 1.00. Zone III, the central part of the basin, is the zone of slowest water flow and has the lowest U234/U238 ratios (1.3-1.8), averaging 1.6. Average deuterium concentration is 1.02 and the maximum is 1.05. Zonal distribution of the U234/U238 ratio corresponds to such hydrochemical indices as the deuterium concentration, the coefficient of water migration and the age of the groundwaters. The importance of these data will be substantially increased if determinations of isotopic composition of uranium in water-bearing rocks are included in the investigations. (Josefson-USGS)
W72-04687

2G. Water in Soils

A FINITE DIFFERENCE METHOD FOR UNSTEADY FLOW IN VARIABLY SATURATED POROUS MEDIA: APPLICATION TO A SINGLE PUMPING WELL,
Nevada Univ., Reno. Center for Water Resources Research.
For primary bibliographic entry see Field 02F.
W72-04163

EVALUATION OF THE FIELD PERCOLATION TEST AND AN ALTERNATIVE PROCEDURE TO TEST SOIL POTENTIAL FOR DISPOSAL OF SEPTIC TANK EFFLUENT,
Wisconsin Univ., Madison. Geological and Natural History Survey.
For primary bibliographic entry see Field 05B.
W72-04186

GENERAL THEOREM ON STEADY INFILTRATION FROM SURFACE SOURCES, WITH APPLICATION TO POINT AND LINE SOURCES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.
J. R. Philip.
Soil Science Society of America Proceedings, Vol 35, No 6, p 867-871, November-December 1971. 2 fig, 8 ref.

Descriptors: *Infiltration, *Soil water movement, *Unsaturated flow, *Furrow irrigation, *Pit recharge, Mathematical studies, Steady flow, Diffusion, Convection.
Identifiers: Trickle irrigation.

A general theorem enables the solution of the quasilinearized steady infiltration equation for any distribution of surface sources to be found immediately from the corresponding (mathematically simpler) solution for buried sources. It is introduced through the special cases of the surface line and point sources. These solutions hold also for steady infiltration from furrows and basins. Corollary to the general theorem, relations of the same type hold between the horizontal flux density components. Both the theorems and the special results apply also to processes such as diffusion in a uniform convective flow and sedimentation under gravity and Brownian motion. (Knapp-USGS)
W72-04187

WATER AND SOLUTE MOVEMENT IN SVEA LOAM FOR TWO WATER MANAGEMENT REGIMES,
North Dakota State Univ., Fargo. Dept. of Soils.
D. K. Cassel.
Soil Science Society of America Proceedings, Vol 35, No 6, p 859-866, November-December 1971. 8 fig, 3 tab, 19 ref.

Descriptors: *Soil water movement, *Leaching, *Mass transfer, *Solutes, *Ion transport, Translocation, Saline soils, Evaporation, Soil chemistry, Fertilizers, Irrigation effects, Irrigation practices, Nitrates, Chlorides.

Soil water and soil solute movement were investigated in a sub-humid environment over a 3-month period for two water regimes. Ammonium nitrate and KCl were broadcast on duplicate 3.7-m square plots. Each plot was irrigated with 6 to 10 cm of water at 7- to 14-day intervals. One plot was covered to prevent exchange of water at the soil surface (covered plot) while the second remained bare and was thus subjected to the prevailing environmental conditions. Soil water flux and unsaturated hydraulic conductivity values were calculated using soil water pressure and water content data from the covered plot. Analyses of soil solution collected from 30-, 61-, 91-, 122-, and 152-cm depths for NO3-N and Cl revealed that, for the environmental conditions encountered (35 cm pan evaporation and 15 cm rainfall), downward movement of ions was nearly 1.5 times greater for the covered compared with the bare plot. The solute did not move with the soil water in a one to one relationship for either plot. (Knapp-USGS)
W72-04188

FACTORS AFFECTING MASS MOVEMENT OF FOUR SOILS IN THE WESTERN CASCADES OF OREGON,
Oregon State Univ., Corvallis. Dept. of Soils.
R. C. Paeth, M. E. Harward, E. G. Knox, and C. T. Dyrness.
Soil Science Society of America Proceedings, Vol 35, No 6, p 943-947, November-December 1971. 4 tab, 33 ref.

Descriptors: *Mass wasting, *Soil mechanics, *Mineralogy, *Oregon, Provenance, Weathering, Clays, Clay minerals, Soil moisture, Mudflows.
Identifiers: Cascades (Oregon).

Four soils derived from tuffaceous rock in the Western Cascades were studied to determine relationships to slope stability. Two of the soils derived from greenish tuff and breccia were prone to slope failure. The other two soils were derived from yellowish and reddish tuff and breccia and were more stable. Soils prone to slope failure were characterized by high amounts of smectite clay, absence of kaolin, and moderate amounts of free iron oxide. The more stable soils contained kaolin, more chlorite intergrades, less smectite, and higher amounts of free iron oxide. Pseudomorphs of clay were the major component of silt and sand fractions. The pseudomorphs seem to function mechanically as primary soil particles but the clay contributes to cation exchange and moisture retention. The ratio of clay calculated from 15-bar moisture retention to measured clay was highest in the most stable soils. Stability of these soils did not appear to correlate with clay content, content of amorphous clay, or proportions of exchangeable cations. (Knapp-USGS)
W72-04189

MISCIBLE DISPLACEMENT OF AMMONIA IN SOIL; DETERMINING SORPTION ISOTHERMS,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 02K.
W72-04190

NUMERICAL APPROXIMATION OF CATION EXCHANGE IN MISCIBLE DISPLACEMENT THROUGH SOIL COLUMNS,
Utah State Univ., Logan. Dept. of Soil Science and Biometeorology.
For primary bibliographic entry see Field 02K.
W72-04191

ADSORPTION OF DDT ON SOLID PARTICLES,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 05B.
W72-04192

RETENTION OF THREE INSECTICIDES ON DIFFERENT SIZE SOIL PARTICLES SUSPENDED IN WATER,
Agricultural Research Service, Orono, Maine. Dept. of Plant and Soil Science.
For primary bibliographic entry see Field 05B.
W72-04193

CALCIUM COMPLEXING AND THE ENHANCED SOLUBILITY OF GYPSUM IN CONCENTRATED SODIUM-SALT SOLUTIONS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02K.
W72-04194

SOIL WATER EVAPORATION: LONG-TERM DRYING AS INFLUENCED BY SURFACE RESIDUE AND EVAPORATION POTENTIAL,
Agricultural Research Service, Mandan, N. Dak. Soil and Water Conservation Research Div.
J. J. Bond, and W. O. Willis.
Soil Science Society of America Proceedings, Vol 35, No 6, p 984-987, November-December 1971. 7 fig, 1 tab, 19 ref.

Descriptors: *Evaporation, *Earth-water interfaces, *Mulching, Drying, Soil water movement, Temperature, Soil surfaces, Stubble mulching.
Identifiers: Evaporation potential.

Evaporation with time was measured from wetted columns of fine sandy loam treated with seven rates of surface residue and subjected to six different evaporation potentials (shaded and unshaded columns in each of three trials). With either shaded or unshaded columns, increasing the rate of soil water evaporation by increasing evaporation potentials or by decreasing rates of surface residue resulted in greater total soil water evaporation after 60 days drying. Surface residue influenced soil temperatures during first and third stage drying and decreased the range between maximum and minimum temperature. (Knapp-USGS)
W72-04195

WATER INFILTRATION CONTROL: A CHANNEL SYSTEM CONCEPT,
Nevada Univ., Reno. Dept. of Soil Science.
R. M. Dixon, and A. E. Peterson.
Soil Science Society of America Proceedings, Vol 35, No 6, p 968-973, November-December 1971. 6 fig, 2 tab, 8 ref.

Descriptors: *Infiltration, *Soil texture, *Porosity, *Pores, *Soil water movement, Unsaturated flow, Hydraulic conductivity, Percolation, Wetting.

A channel system concept of infiltration was developed to describe the influence of large soil pores on the movement of soil water and air. This concept hypothesizes that soil surface conditions or channel system states control the flow of water and air in subsurface networks of large pores. Six channel system states (A through F), representing common soil surface conditions, form the basis for controlling infiltration within a range often exceeding one order of magnitude. Channel system states A, B and C represent rough surfaces with open, constricted and closed channel ports; whereas states D, E and F represent smooth surfaces with open, constricted and closed channel ports. Infiltration rates usually vary in the order A, B, D, C, E, F. Under state A the soil surface and subsurface channels are hydraulically and pneumatically connected, and under state F they are disconnected. Under state A water penetration rates are rapid and flow routes are relatively direct, whereas under state F rates are slow and routes are extremely tortuous. Soil surface management can be directed to achieving the desired channel system state and hence the design level of infiltration. The channel system concept appears applicable to a wide range of infiltration-related problems. (Knapp-USGS)
W72-04196

BOUNDARY CONDITIONS AND CONDUCTIVITIES USED IN THE ISOTHERMAL MODEL OF EVAPORATION FROM SOIL,
Department of Agriculture, Ottawa (Ontario). Soil Research Inst.
W. J. Staple.
Soil Science Society of America Proceedings, Vol 35, No 6, p 853-855, November-December 1971. 3 fig, 12 ref.

Descriptors: *Evaporation, *Soil moisture, Numerical analysis, Air-earth interfaces, Winds, Temperature, Humidity, Vapor pressure, Model studies, Mathematical models.
Identifiers: Soil water evaporation.

The surface boundary conditions in the isothermal model for computing evaporation from soil may be expressed in terms of the wind speed, temperature, and humidity of the ambient air. Use of these parameters along with reduced nodal spacings near the surface yields evaporative fluxes that closely follow the differences in vapor pressure between soil and atmosphere. A simple evaporation experiment was used to show that evaporation rates and soil moisture distributions obtained with these revised boundary conditions are closer to experimental values than those obtained with conditions defined in terms of potential evaporation and moisture content. (Knapp-USGS)
W72-04197

EVAPORATION FROM BARE SOIL AS AFFECTED BY TEXTURE AND TEMPERATURE,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
R. E. Campbell.
Forest Service Research Note RM-190, 1971. 7 p, 5 fig, 2 tab, 6 ref.

Descriptors: *Evaporation, *Soil water, *Air temperature, *Soil texture, *Hydrologic data, Analytical techniques, Soil types, Drying, Water loss, Laboratory tests, Soil moisture, Soil temperature.

Evaporation of water under several drying conditions was studied in six soils from the semiarid upper Rio Puerco drainage of New Mexico. Evaporation from initially saturated soils exposed to the atmosphere was 0.33 inch per day at 90 deg F. and 0.22 inch per day at 60 deg F. Sandy soils lost half of their moisture in 5 and 7 days at 90 deg and 60 deg F, respectively, compared to 8 and 15 days for clay soils under similar conditions. After rapid initial moisture loss, the dried surface of sandy soils acted as a barrier to further moisture loss. (Woodard-USGS)
W72-04199

THE LOOK OF OUR LAND--AN AIRPHOTO ATLAS OF THE RURAL UNITED STATES: THE MOUNTAINS AND DESERTS.
Economic Research Service, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04338

EFFECT OF PH ON THE FORMATION OF CLAY MINERAL-PROTEIN COMPLEXES,
New Hampshire Univ., Durham. Dept. of Soil and Water Science.
Jenoe T. Albert.
M. S. Thesis, August 1971. 56 p, 11 fig, 12 photo, 5 tab, 27 ref. A-020-NH (1).

Descriptors: *Adsorption, Centrifugation, Water purification, *Proteins, *Hydrogen ion concentration, Illite, Kaolinite, Flocculation, Electron microscopy, Sodium, Cation exchange, Montmorillonite, *Proteins, Spectrophotometry, *Colloids, X-ray diffraction, *Clay minerals.
Identifiers: Vermiculite, Interlayer adsorption, Isoelectric point.

The effect of suspension pH and clay mineral type on removal, by clay, of lysozyme and ovalbumin from solution has been investigated. The amount of the two proteins which was adsorbed by all clays except kaolinite appeared to be influenced by the clay suspension pH. Adsorption of both proteins increased as the clay suspension pH approached the protein isoelectric point. Furthermore, in unbuffered systems, adsorption of ovalbumin was observed at suspension pH values considerably above the protein isoelectric point. In this pH range, both protein and clay were expected to be negatively charged. In most cases, montmorillonite adsorbed the greatest amount of protein followed, in order, by vermiculite, illite, and kaolinite. X-ray diffractometry and electron microscopic observations indicated that lysozyme was adsorbed interlayer by montmorillonite. In all other complexes, protein appeared to be adsorbed only on external surfaces, especially near the clay edges. (Harter-New Hampshire)
W72-04445

UTILIZATION OF MULL (FOREST HUMUS LAYER) IN GEOCHEMICAL EXPLORATION IN THE EMPIRE DISTRICT, CLEAR CREEK COUNTY, COLORADO,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02K.
W72-04516

A THEORETICAL STUDY OF INFILTRATION INTO RANGE AND FOREST SOILS,
Utah State Univ., Logan. Coll. of Engineering.
J. E. Fletcher, and Y. A. El-Shafei.
Utah Water Research Laboratory Report PRWG60-1, July 1970. 37 p, 25 fig, 3 tab, 18 ref, 2 append. USDA Grant Utah No 1-4040 (4000) USU.

Descriptors: *Soil water movement, *Infiltration, *Soil properties, *Rainfall simulations, *Rainfall-runoff relationships, Theoretical analysis, Ranges, Forests, Mathematical studies, Hydrologic data, Equations, Numerical analysis.
Identifiers: *Rainfall infiltration rates.

More than 400 rainfall simulator experiments were examined to detect which soil properties could be used to compute infiltration time relationships. Three theoretical equations were tested to determine their efficacy for calculating infiltration time relationships from soil and site characteristics. Both the modified Green and Ampt, and Fletcher equations were successfully used. Darcian-type equations were developed on laboratory type samples which would show the relation between soil, solution and rainfall properties and infiltration. These latter equations have not been tested on undisturbed soils but give excellent agreement between measured and computed values for time before flooding and infiltration time relationships. (Woodard-USGS)
W72-04656

APPLICATION OF VARIATIONAL PRINCIPLE FOR THE SOLUTION OF THE GRAVITY DRAINAGE PROBLEM,
Regional Inst. of Tech., Jamshedpur (India). Dept. of Applied Mechanics.
J. K. Pradhan, and S. V. K. Sarma.
Journal of Hydraulic Research, Vol 9, No 4, p 565-590, 1971. 3 fig, 2 tab, 12 ref.

Descriptors: *Unsteady flow, *Unsaturated flow, *Numerical analysis, Equations, Porous media, Soil water movement, Percolation, Drainage, Infiltration, Recharge, Hysteresis.

The gravity drainage process under unsteady partially saturated conditions is described by nonlinear parabolic partial differential equations with gravity terms included. The nonlinearity is due to the variation of diffusivity and permeability of the medium with moisture content. The equation may be solved by the variational method, similar to the solution for heat flow. To make the problem simpler, a constant diffusivity and a linearly varying permeability are assumed. The procedure helps to reduce the equation into a system of Lagrangian equations which are directly solvable. A practical example is given to illustrate the utility of the method. (Knapp-USGS)
W72-04674

WATER MOVEMENT IN DRY SOILS. II. AN ANALYSIS OF HYSTERESIS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia).
D. A. Rose.
Journal of Soil Science, Vol 22, No 4, p 490-507, December 1971.

Descriptors: *Soil water movement, *Hysteresis, *Diffusivity, *Hydraulic conductivity, Soil structure, Unsaturated flow, Soil physical properties.

Identifiers: Dry soils.

The hysteresis of soil conductivity and diffusivity as functions of water content and water potential between sorption and desorption was examined for sand, loam, clay, and sepiolite. These materials, all aggregated, are sufficiently dry that both the vapor and liquid components of water movement are important. At any water content or water potential the vapor conductivity is always greater when wetting than when drying. Hysteresis in water (vapor + liquid) conductivity is a function of water content when vapor flow is dominant. Conversely, hysteresis in water conductivity is a function of water potential when liquid flow is dominant. Both forms of this hysteresis are small. Hysteresis in diffusivity as a function of both water content and water potential exists, but is complicated. Variations caused by hysteresis are likely to be negligible in practice, swamped by effects caused by changes in the soil environment or by changes in soil management. (Knapp-USGS)
W72-04676

LEACHING OF EUPHRATES SALINE SOIL IN LYSIMETERS,
Baghdad Univ. (Iraq).
For primary bibliographic entry see Field 02K.
W72-04677

NONEQUILIBRIUM URANIUM IN GROUNDWATERS OF THE TASHKENT ARTESIAN BASIN (NERAVNOVESNYY URAN V PODZEMNYKH VODAKH PRITASHKENTSKOGO ARTEZIANSKOGO BASSEYNA),
Hydrogeology and Engineering Geology, Tashkent (USSR).
For primary bibliographic entry see Field 02F.
W72-04687

2H. Lakes

ECOLOGICAL EFFECTS OF A THERMAL POWER PLANT ON THE AQUATIC HABITAT OF A LARGE FRESH WATER LAKE IN THE UNITED STATES,
Detroit Edison Co., Mich.; and Michigan State Univ., East Lansing.
For primary bibliographic entry see Field 05C.
W72-04110

DEVELOPMENT AND EVALUATION OF CITIZEN PARTICIPATION TECHNIQUES FOR INLAND LAKE AND SHORELAND MANAGEMENT,
Huron River Watershed Council, Ann Arbor, Mich.
For primary bibliographic entry see Field 06B.
W72-04122

EFFECTS OF SECONDARY AND TERTIARY WASTEWATER EFFLUENTS ON ALGAL GROWTH IN A LAKE-RIVER SYSTEM,
Pacific Northwest Water Lab., Corvallis, Oreg.
For primary bibliographic entry see Field 05C.
W72-04219

ANNUAL REPORT OF ACTIVITIES DURING FISCAL YEAR 1971.
Maine Univ., Bangor. Water Resources Center.
For primary bibliographic entry see Field 05C.
W72-04261

LIMNOLOGICAL CHARACTERISTICS OF NORTH AND CENTRAL FLORIDA LAKES,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05C.
W72-04269

ONONDAGA LAKE STUDY.
Onondaga County, Syracuse, N.Y.
For primary bibliographic entry see Field 05C.
W72-04277

ADENOSINE TRIPHOSPHATE IN LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 05C.
W72-04292

THE LAKE NOQUEBAY PROJECT: REPORT ON THE FIRST PHASE IN A MULTI-DISCIPLINARY STUDY OF A RECREATIONAL LAKE,
Wisconsin Univ., Green Bay.
For primary bibliographic entry see Field 06B.
W72-04293

DISTRIBUTIONAL ECOLOGY AND BEHAVIORAL THERMOREGULATION OF FISHES IN RELATION TO HEATED EFFLUENT FROM A STEAM-ELECTRIC POWER PLANT (LAKE MONONA, WISCONSIN),
Wisconsin Univ., Madison. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W72-04295

THE NIAGARA RIVER PLUME, PART 1 - TEMPERATURE AND CURRENT STRUCTURE IN THE NIAGARA RIVER PLUME,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
H. S. Weiler.
Canada Department of Energy, Mines and Resources Inland Waters Branch Technical Bulletin No 38, 1971. 28 p, 18 fig, 1 tab, 4 ref.

Descriptors: *Water circulation, *Movement, *Water temperature, *Lake Ontario, *Inflow, River flow, Tracking techniques, Winds, Lake breezes, Analytical techniques, Dispersion.
Identifiers: *Niagara River, Infrared imagery, Plume characteristics.

The dynamic behavior of the plume off the mouth of Niagara River in Lake Ontario is described in terms of gross movement. The results of temperature surveys, drogue tracking experiments, and infrared line scanner mosaics show that the river's plume is strongly influenced by the dominant winds of the day before the experiment, and to a lesser extent those of the preceding day. Response time of the plume to persistent changes in wind, was estimated to be between 1 and 2 days. Surface currents in the lake, driven by over-lake winds, controlled the motion of the plume; the motion was quite varied and complex, depending on the wind fields encountered. The edge of the plume on the side away from the direction the plume moved, was usually well defined; the other edge was more diffuse and often had large eddies. These details were obtained mostly from the infrared mosaics. Temperature measurements showed close to isothermal conditions in the bar area in early spring. As the summer progressed, a thermocline developed outside the bar, but generally isothermal conditions existed inside the bar area. The plume under these conditions tended to flow out over the lake's surface, and appeared to entrain colder and deeper water from further out in the lake. (Woodard-USGS)
W72-04328

WIND-DRIVEN CURRENTS IN A LARGE LAKE OR SEA,
Northwestern Univ., Evanston, Ill. Dept. of Engineering Sciences; and Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
G. E. Birchfield.
Available from NTIS, Springfield, Va. 22151 - $3.00 printed copy, $0.95 cents microfiche. Argonne National Laboratory Report ANL/ES-6, July 1971. 17 p, 1 ref. NSF GA-1078.

Descriptors: *Currents (Water), *Winds, *Mass transfer, *Lakes, *Model studies, Sea breezes, Mathematical studies, Equations, Water pollution sources, Path of pollutants, Dynamics.

A linear model of the Ekman dynamics for a large shallow homogeneous lake or sea was constructed to examine the mass transport balance, in particular the vertical mass flux. The role of coastal upwelling was examined for steady uniform and nonuniform wind-stress forcing. The model incorporates the earth's rotation, and the Rossby number is assumed small enough to neglect the convective terms in the equations of motion. Horizontal and vertical turbulent mixing is incorporated in the simplest way. Because the horizontal scale of wind systems is large relative to the lake size, the model wind stress is taken as either uniform or with uniform curl, and steady in time. The important feature of small mean-depth-to-width ratio of a large lake is imposed on the model. The geometry of the model has, however, been simplified to a rectangular basin of uniform depth. (Woodard-USGS)
W72-04335

CHANGES IN THE ELEVATION OF GREAT SALT LAKE CAUSED BY MAN'S ACTIVITIES IN THE DRAINAGE BASIN,
Geological Survey, Salt Lake City, Utah.
For primary bibliographic entry see Field 04A.
W72-04370

SOME MESOSCALE FEATURES OF THE INITIAL FIELDS OF MOTION AND TEMPERATURE FOR A LAKE-INDUCED WINTER DISTURBANCE,
Meteorological Service of Canada, Toronto (Ontario).
G. V. Rao.
Journal of Applied Meteorology, Vol 10, No 4, p 694-702, August 1971. 5 fig, 1 tab, 13 ref, 2 append.

Descriptors: *Weather patterns, *Storms, *Surface waters, *Winter, *Lake Ontario, Snow, Winds, Lakes, Model studies, Forecasting, Meteorology, Water temperature, Air temperature, Latent heat, Advection, Precipitation (Atmospheric).

A primitive equation model was used to describe the initial fields of atmospheric motion, temperature and humidity for a snow-squall situation over Lake Ontario. Of primary interest is the initial vertical velocity field which was obtained through solving a three-dimensional vertical velocity equation. Conventional surface and upper winds and geopotential heights for ten isobaric surfaces were plotted on a large area base map and subjectively analyzed. These analyses were transferred to a local area base map for Lake Ontario. Initial data consisted of winds over the region and geopotential heights on the boundary. The model produced initial vertical velocities that were consistent with the commonly associated features of the reported weather, and also with some earlier subjective estimates. Analysis of the vertical velocity field revealed that the ascent over the south-central side of the lake resulted primarily as a consequence of the imbalance between the configurations of the thermal stability and advection fields. Latent heat of vaporization released from condensation caused by the large-scale ascent also helped to intensify the mesoscale vertical velocities. (Woodard-USGS)
W72-04393

INTERACTIONS OF DISSOLVED AND PARTICULATE NITROGEN IN LAKE METABOLISM,
Michigan State Univ., East Lansing.
For primary bibliographic entry see Field 05C.
W72-04458

MOVEMENTS IN CONTINUOUS LAKE ICE SHEETS AND TEMPERATURE GRADIENTS IN AN ICE SHEET,
Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02C.
W72-04530

ANNOTATED BIBLIOGRAPHY ON FRESH-WATER ICE.
Lake Survey Center, Detroit, Mich.
For primary bibliographic entry see Field 02C.
W72-04585

A NOTE ON THE LIMNOLOGY OF LAKE HAYQ, ETHIOPIA,
Haile Sellassie I Univ., Addis Ababa (Ethiopia). Dept. of Chemistry.
R. M. Baxter, and D. L. Golobitsh.
Limnology and Oceanography, Vol 15, No 1, 1970, p 144-149. 3 fig, 2 tab, 14 ref.

Descriptors: *Limnology, *Lakes, Temperature, *Hydrogen ion concentration, Opacity, Bicarbonate carbonate, Magnesium, Sodium, Calcium, Potassium, Conductivity, Stratification.
Identifiers: Ethiopian highland lake, Anions, Cation, Ethiopia, *Lake Hayq (Ethiopia).

In January 1969, a study of the limnology of Lake Hayq was conducted. The only previous study of this type for these waters was performed by an Italian group in 1938. When account is taken of the different times of year for the two studies, the results of these two efforts agree consistently. Lake Hayq is an Ethiopian highland lake fed by a single river and has no apparent outlet. It has an area of 23 sq. km. and a maximum depth of over 80 m. The conductivity of the lake water was about 800 micro-mhos/cm; the total ionic concentration was 10 meq/l. The predominant cation was magnesium, followed by sodium, calcium and potassium in that order; predominant anions were carbonate and bicarbonate, followed by chloride. The pH of the water was about 9.0. There was some stratification of silica and phosphate at the time of sampling. The lake is a fairly typical African Class II lake, but it differs from other Ethiopian lakes of this class in the remarkable transparency of its water (the vertical extinction coefficient for green light was about 0.17/m.), its very low density of plankton and the depth of the oxygenated layer (about 40 m.). (Goessling-Texas)
W72-04599

2I. Water in Plants

ANALOGUE SIMULATION OF AN ION UPTAKE PROCESS,
Louvain Univ. (Belgium).
H. Laudelout, and Ph. Verdonck.
In: Proceedings of a Research Co-ordination Meeting, Organized by the Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture, Sofia, 1-5 December 1969. p 115-118.

Descriptors: *Ions, *Absorption, *Enzymes, *Soil-water-plant relationships, Computer models, Analog computers.
Identifiers: Film-controlled uptake.

The depletion zone in the vicinity of an absorbing surface slows uptake. The differential equation describing film-controlled uptake of a Michaelis-Menten, enzyme-catalyzed reaction was solved, using an analogue computer, under the conditions that the contact time was 30 min. and the concentration was that at which the uptake rate was half the maximum. It was determined that the ratio of the actual uptake rate to that in the absence of a depletion zone is reduced by about a factor of 4 when the Michaelis-Menten rate constant is decreased an order of magnitude. (Bopp-ORNL)
W72-04447

NITROGEN-15 IN SOIL-PLANT STUDIES.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 05B.
W72-04448

INFLUENCE OF MICROORGANISMS ON ASSIMILATION OF NITROGEN BY PLANTS FROM SOIL AND FERTILIZER SOURCES,
Agricultural Research Council, Wantage (England). Letcombe Lab.
For primary bibliographic entry see Field 05B.
W72-04450

2J. Erosion and Sedimentation

FORMATION OF RIFFLES AND POOLS,
Illinois State Water Survey, Urbana.
C. T. Yang.
Water Resources Research, Vol 7, No 6, p 1567-1574, December 1971. 6 fig, 7 ref. OWRR B-051-ILL (1).

Descriptors: *Channel morphology, *Meanders, *Sedimentary structures, Regime, Scour, Hydraulics, Alluvial channels, Sediment transport, Energy dissipation, Geomorphology.
Identifiers: Riffles, Pools.

The formation of riffles and pools in natural streams is a means of self-adjustment that minimizes their time rate of potential energy expenditure per unit mass of water in accordance with the law of least time rate of energy expenditure. The actual formation of pools and riffles is a combined process of dispersion and sorting. The locations of riffles and pools are related to the geometry of a meandering river. Pools are associated with bends, whereas riffles are ususally centered at crossings. River meandering and the pool-riffle phenomena are results of the same process. (Knapp-USGS)
W72-04164

GEOLOGY OF MCLEAN COUNTY, NORTH DAKOTA,
North Dakota Geological Survey, Grand Forks.
J. P. Bluemle.
North Dakota Geological Survey, Bulletin 60 - Part 1, and North Dakota Water Commission County Ground Water Studies 19-Part 1, 1971. 65 p, 25 fig, 3 plate, 25 ref.

Descriptors: *Sedimentation, *Alluvial channels, *Geology, *Sediment transport, *North Dakota, Erosion, Topography, Rocks, Stratigraphy, Land forming, Glacial soils, Melt water, Scour, Rivers, Bedrock, Streamflow.
Identifiers: McLean County (N Dak).

McLean County, North Dakota is underlain by 8,500 to 13,000 feet of Paleozoic, Mesozoic, and Cenozoic rocks that dip to the west at low angles. The Tertiary, Cannonball, Tongue River, and Sentinel Butte Formations lie directly beneath glacial drift. The Tongue River and Sentinel Butte Formations are widely exposed in McLean County, and the Cannonball Formation is exposed in a few places. Glacial drift occurs throughout the county and reaches a maximum thickness of at least 400 feet in certain preglacial valleys. Alluvial sediment occurs along stream and river channels throughout McLean County. It ranges from a few feet thick along some of the smaller streams to over 100 feet thick in places beneath the Missouri River floodplain. The alluvial sediments consist mainly of clay, silt, sand, and gravel. Silts and clays commonly comprise about 90% of the sediments, sand and gravel the remaining 10%. The present route ot the Missouri River from Riverdale southward was established during late Wisconsinan time. Large erosion surfaces were cut in the area southeast of Riverdale as the water flowed overland until a distinct trench was cut. (Woodard-USGS)
W72-04170

ICE-CORED MORAINES IN SOUTH-WESTERN ELLESMERE ISLAND, N.W.T., CANADA,
Brussels Univ. (Belgium). Geomorphology Service.
For primary bibliographic entry see Field 02C.
W72-04183

FACTORS AFFECTING MASS MOVEMENT OF FOUR SOILS IN THE WESTERN CASCADES OF OREGON,
Oregon State Univ., Corvallis. Dept. of Soils.
For primary bibliographic entry see Field 02G.
W72-04189

SUMMARY OF ALLUVIAL-CHANNEL DATA FROM RIO GRANDE CONVEYANCE CHANNEL, NEW MEXICO, 1965 - 69,
Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 08B.
W72-04336

SEDIMENT TRANSPORT BY STREAMS IN THE SNOHOMISH RIVER BASIN, WASHINGTON, OCTOBER 1967-JUNE 1969,
Geological Survey, Tacoma, Wash. Water Resources Div.
L. M. Nelson.
Geological Survey Open-file Report, 1971. 44 p, 28 fig, 2 tab, 19 ref.

Descriptors: *Sediment transport, *Streamflow, *Sediment discharge, *Sediment load, *Washington, River basins, Sedimentation, Hydrologic data, Data collections, Sediment yield, Floods, Vegetation, Precipitation (Atmospheric), Erosion.
Identifiers: *Snohomish River basin (Wash).

Annually, most of the sediment transport in streams of the Snohomish River basin is discharged in a few days during periods of high streamflow. The sediment discharge increased nearly 300 percent from 1967 to 1968, even though streamflow increased only about 14 percent. The streamflow during 1967 water year was slightly above the 30-year average. The measured suspended-sediment concentrations, which increase rapidly with increasing streamflow, ranged from less than 1 to 2,430 milligrams per liter. The estimated annual suspended-sediment yields from subbasins within the Snohomish River basin during the 1967 and 1968 water years ranged from less than 50 to 1,290 tons per square mile. Only slight changes in the sediment-transport pattern occur as a result of human activity. High rates of sediment transport which result from logging and road construction usually are of short duration because the protective vegetative cover has a fast recovery rate. (Woodard-USGS)
W72-04337

HYDROLOGY AND SEDIMENTATION OF COREY CREEK AND ELK RUN BASINS, NORTH-CENTRAL PENNSYLVANIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04A.
W72-04346

INFLUENCE OF RELIEF ON SURFACE SOIL EROSION (VLIYANIYE REL'YEFA NA POVERKHNOSTNYY SMYV POCHV),
Gidrometeorologicheskii Institut, Odessa (USSR).
G. I. Shvebs.
In: Sbornik rabot po gidrologii, No 9; Gosudarstvennyy Gidrologicheskiy Institut, Leningrad, Gidrometeoizdat, p 83-105, 1970. 5 fig, 3 tab, 36 ref.

Descriptors: *Soil erosion, *Gully erosion, Rill erosion, *Topography, *Slopes, Watersheds (Basins), Soils, Vegetation, Washouts, Flow rates, Surface runoff, Subsurface runoff, Sprinkling, Erosion control, United States, Geographical regions, North Carolina.
Identifiers: *USSR, Monoliths, Runoff plots, Conveyance.

Influence of relief on surface soil erosion is expressed by changes in flow velocity and concentration with changing gradient, length and shape of slope, type of catchment, and degree of slope dis-

section by rills. Influence of slope gradient on erosion was studied by artificial sprinkling. According to the data available, erosion varies between the 0.7 power of the gradient for erosion-resistant areas and the 1.6 power of the gradient for newly cultivated surfaces, the average value being 1.2. As indicated by theoretical analysis and summary of available experimental investigations, soil erosion varies between the 0.45 and 0.50 power of slope length. The expression, reflecting change in erosion for slopes, was found by differentiating the soil erosion equation obtained for a uniform slope. The relief is influenced by a change in the concentration of surface runoff and is taken into account by converting actual slope length to a computed length dependent on the type of catchment. Influence of gully slope dissection is determined by previously established relief parameters adjusted for changes in individual slope microcatchments. Present erosion control practices take into account the effects of relief on soil erosion on both uniform and complex slopes. (Josefson-USGS)
W72-04360

PRE-WISCONSIN GLACIAL DIVERSION OF THE HOUSATONIC RIVER IN NORTHWESTERN CONNECTICUT,
Geological Survey, Washington, D.C.
C. R. Warren.
Available from GPO, Washington, DC 20402, Price $2.50. Geological Survey Research 1971, Chapter D, Professional Paper 750-D, p D132-D137, 1971. 2 fig, 5 ref.

Descriptors: *Geomorphology, *Topography, *Connecticut, *Valleys, *Glaciation, Erosion, Glacial drift, Glaciers, Pleistocene epoch, Land forming, Drainage patterns (Geologic).
Identifiers: *Housatonic River (Conn), Preglacial topography.

The Housatonic River was diverted from its preglacial valley at least once, and probably twice, in the part of its course 0.2-0.6 mile below West Cornwall, Conn. One of the diversions, and probably both, occurred longer ago than the Wisconsin Glaciation. Thus, the tills that caused these diversions probably date from two separate pre-Wisconsin glaciations. This evidence supports the inference that the lower till, widespread in the area, dates from pre-Wisconsin time. If it does, much of the topography of western Connecticut reflects pre-Wisconsin glacial events. (Knapp-USGS)
W72-04375

THE PREGLACIAL KENTUCKY RIVER OF NORTHERN KENTUCKY,
Geological Survey, Erlanger, Ky.
W. C. Swadley.
Available from GPO, Washington, DC 20402, Price $2.50. Geological Survey Research 1971, Chapter D, Professional Paper 750-D, p D127-D131, 1971. 2 fig, 9 ref.

Descriptors: *Valleys, *Pleistocene epoch, *Kentucky, Geomorphology, Erosion, Topography, Glacial drift, Drainage patterns (Geologic), Glaciation.
Identifiers: *Kentucky River valley, Preglacial valleys.

An abandoned high-level river valley extends from the Kentucky River near Carrolton, Ky., northeast to the mouth of the Great Miami River at Lawrenceburg, Ind., a distance of about 40 miles. The geographic location, gradient, and fluvial-sediment content of this valley identify it as the preglacial course of the Kentucky River. It follows closely the Ohio River valley but only locally coincides with it. Glaciation reversed the flow of this part of the ancestral Kentucky River and established the course of the Ohio River downstream from Lawrenceburg. Glacial deposits filling the preglacial valley probably prevented the newly formed Ohio River from occupying most of the old valley. (Knapp-USGS)
W72-04376

GLACIATION OF THE RAY MOUNTAINS, CENTRAL ALASKA,
Geological Survey, Menlo Park, Calif.
W. Yeend.
Available from GPO, Washington, DC 20402, Price $2.50. Geological Survey Research 1971, Chapter D, Professional Paper Paper 750-D, p D122-D126, 1971. 5 fig, 8 ref.

Descriptors: *Glaciation, *Pleistocene epoch, *Alaska, Glaciers, Glacial drift, Stratigraphy, Erosion, Topography, Geomorphology.
Identifiers: *Ray Mountains (Alaska).

The Ray Mountains in central Alaska show evidence of two Pleistocene glaciations. Glaciers as much as 12 miles long occupied the valleys, draining the high, eastern part of the mountains. Remnants of lateral moraines indicate at least three stillstands of the ice during an early Wisconsin glaciation. Hummocky moraines on the high mountain cirque floors were deposited by local cirque glaciers during the late Wisconsin. Glaciers originating in the Ray Mountains in Wisconsin time stopped 28 miles short of the Yukon River and therefore could not have dammed the major drainage. Ice more or less equally distributed around the high parts of the mountains was most likely nourished by precipitation originating in the North Pacific Ocean and Bering Sea. (Knapp-USGS)
W72-04377

GROWTH AND MOVEMENT OF DUNES AT WHITE SANDS NATIONAL MONUMENT, NEW MEXICO,
National Park Service, Yellowstone National Park, Wyo.
E. D. McKee, and J. R. Douglass.
Available from GPO, Washington, DC 20402, Price $2.50. Geological Survey Research 1971, Chapter D, Professional Paper 750-D, p D108-D114, 1971. 3 fig, 6 tab, 4 ref.

Descriptors: *Dunes, *Gypsum, *New Mexico, *Sedimentation, Winds, Sediment transport, Sands, Surveys, Stratigraphy.
Identifiers: White Sands (N Mex).

The manner and rate of growth of selected dunes at White Sands National Monument, N. Mex., were investigated. Deposits directly below the dune crests were relatively impermanent because total accumulation was affected by periodic avalanching on slip faces. On the lower part of a lee face, large accumulations of sand accrued periodically from shearing on slip faces; losses were few. Near the base, avalanche sands intertongued with deposits of well-stratified sand carried on by crosswinds. In one dune, these mixed deposits accumulated up to 9.6 inches of sand in 5 days, but the monthly average was much lower because wind strength was negligible on many days. Movements ranged from 38 feet per year in embryonic barchan like dunes in the western part of the dune field to no movement in some anchored dunes along the eastern margins. Barchan and transverse dunes in the central area moved 3.5-13 feet per years. (Knapp-USGS)
W72-04378

STRUCTURAL CHARACTERISTICS OF GRANULAR POROUS MEDIA,
Instituto Mexicano del Petroleo, Mexico City.
For primary bibliographic entry see Field 08D.
W72-04385

SOIL EROSION AND CHANNEL PROCESSES (EROZIYA POCHV I RUSLOVYYE PROTSESSY),
Moscow State Univ. (USSR).

Moscow, Moskovskiy Gosudarstvennyy Universitet, 1970. 212 p.

Descriptors: *Soil erosion, *Gully erosion, *Channel erosion, *Rill erosion, *Wind erosion, Soil properties, Soil structure, Soil stability, Particle size, Slopes, Sands, Sand waves, River beds, Sediments, Mudflows, Flood plains, Tundra, Permafrost, Erosion control, Land reclamation.
Identifiers: *USSR, *Water erosion, Erodibility, Deflation (Erosion).

This collection of 17 papers, prepared by a staff of researchers attached to Moscow State University and several other educational establishments, is devoted to a study of erosion and channel processes in different parts of the USSR. A broad range of topics and problems is examined. These include: wind and water erosion of soils; erosion processes on slopes and in tundra zones; gully morphometry and erosion; principles of erosion control; agricultural use of sands; terracing of slopes; grain-size distribution of bottom sediments along sand waves in rivers; river bed stability and channel deformation; erosional and hydraulic characteristics of manmade mudflows; and floodplain classification and topography. The monograph is intended to serve planning and production agencies in various areas of civil and hydraulic engineering and agricultural and industrial research. (Josefson-USGS)
W72-04398

MARINE CHEMISTRY,
For primary bibliographic entry see Field 05B.
W72-04488

MARINE SEDIMENTS AND RADIOACTIVITY,
For primary bibliographic entry see Field 05B.
W72-04489

PRINCIPLES OF AVALANCHE FORECASTING,
Washington Univ., Seattle. Dept. of Atmospheric Sciences.
For primary bibliographic entry see Field 02C.
W72-04525

TRANSPORT OF LARGE ROCKS BY MUDFLOWS (K VOPROSU O PEREMESHCHENII KRUPNYKH KAMNEY SELEVYMI POTOKAMI),
A. N. Oliferov.
In: Sbornik rabot po gidrologii, No 9; Gosudarstvennyy Gidrologicheskiy Institut, Leningrad, Gidrometeoizdat, p 137-141, 1970. 2 fig, 6 ref.

Descriptors: *Mudflows, *Mud, *Debris avalanches, *Landslides, *Rocks, Ravines, Channel morphology, Channel flow, Hydraulic gradient, Cross-sections, High water mark.
Identifiers: *USSR, Carpathians, Crimea, Sphericity, Flatness, Debris cones.

To study movement of large rocks in a mudflow, mudflow cross sections were laid out and large rocks were marked off on mud streams in the Prut, Dniester and Tisa River basins in the Carpathians and on mudflow-risk tributaries of the Voron, Ay-Serez, Uskut and Cheban-Kalle Rivers in the Crimea. Average diameter of rocks selected was measured in accordance with Systematic Instructions of the Hydrometeorological Service; morphometric characteristics determined were sphericity after Krumbein, flatness after Khabakov, and isometry. The transport length of large rocks and various objects in a mudflow depends largely on channel morphology. In the Carpathians a linear relationship was established between the average diameter of the largest rocks transported by mudflows and the average depth of flow. In reaches with an accumulation of large rocks (exceeding 3 m in diameter) in the channel and in reaches where the channel suddenly narrowed and widened, there was no relationship between rock diameter and the distance the rocks were carried. In the Crimea a quantitative relationship between rock diameter, rock transport distance, and gradient may be only derived for

channel reaches where there are no accumulations of large rocks (more than 3 m in diameter), and where the channel does not narrow and widen significantly. (Josefson-USGS)
W72-04541

LONGSHORE SEDIMENT TRANSPORT RATES: A COMPILATION OF DATA,
Army Coastal Engineering Research Center, Washington, D.C.
M. M. Das.
Miscellaneous Paper 1-71, September 1971, 81 p. 16 ref.

Descriptors: *Coastal engineering, *Data collections, *Beaches, *Sediment transport, Beach erosion, Alaska, California, Florida.
Identifiers: *Beach sediments, *Littoral transport, *Longshore sediment transport.

The report is a compilation of data on longshore sediment transport and associated wave and sediment characteristics from six laboratory studies and four field studies. Laboratory observations include water depth, wave height, wave period, sand size, wave generator angle with toe of the beach, and longshore transport rate. Laboratory wave heights range from 0.035 to 0.51 foot, periods from 0.75 to 3.75 seconds, depth from 0.49 to 2.33 feet, generator angles from 10 to 50 degrees, initial beach slope from 1:5.6 to 1:33, median grain size from 0.22 mm. to 1.55 mm., and specific gravities from 1.1 to 2.69. The maximum transport rate near Anaheim Bay, California, is 2,130 cubic yards per day, north; near South Lake Worth Inlet, Florida, is 1,300 cubic yards per day, south. The estimated transport rate at Cape Thompson, Alaska, is 4,680 cubic yards per day; the rate at Silver Strand Beach, California, is 3,400 cubic yards per day.
W72-04551

WORLD-WIDE DISTRIBUTION OF MANGANESE NODULES,
Lamont Geological Observatory, Palisades, N. Y.
D. R. Horn, M. Ewing, B. M. Horn, and M. N. Delach.
Ocean Industry, Vol 7, No 1, p 26-29, January 1972. 4 fig, 8 ref.

Descriptors: *Oceans, *Sedimentation rates, *Manganese, *Clays, *Ocean currents, Deposition (Sediments), Cores, Particle size, Mineral industry, Planning, Oceanography, Atlantic Ocean, Indian Ocean, Pacific Ocean, Mapping.
Identifiers: *Manganese nodules, Oozes, Red clay, Marine mining.

Basic information is presented about the rates of sedimentary processes, rates of deposition, presence or absence of bottom currents, and the regime of abyssal waters in the oceans. Data from 6,000 corings taken from most parts of the different oceans during 25 years have made it possible for scientists to locate and determine the commercial feasibility of mining manganese nodules on the ocean floor. The aim of the report is to provide the marine industry with maps showing distribution of manganese-rich sediments for planning needs. Major provinces of nodules occur where rates of sedimentation are lowest. Outer limits of regions of high nodule concentration mark increases in sedimentation rate due to terrigenous or biologic contributions. In the North Pacific, highest concentration of ferromanganese bodies is along the juncture of red clays and biogenic oozes. In the Atlantic and Indian Oceans, sedimentation rates are higher along continental margins and over midocean ridges. Red clay is the chief sediment in large regions between abyssal plains and the ocean ridges. (Lang-USGS)
W72-04653

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1967, PARTS 1 AND 2. NORTH ATLANTIC SLOPE BASINS AND SOUTH ATLANTIC SLOPE AND EASTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07C.
W72-04663

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1966: PARTS 1 AND 2. NORTH ATLANTIC SLOPE BASINS AND SOUTH ATLANTIC SLOPE AND WASTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04664

THE NEOFORMATION OF CLAY MINERALS IN BRACKISH AND MARINE ENVIRONMENTS,
Sedgwick Museum, Cambridge (England).
C. V. Jeans.
Clay Minerals, Vol 9, No 2, p 209-217, December 1971. 1 tab, 15 ref.

Descriptors: *Clay minerals, *Provenance, *Water chemistry, *Mineralogy, Clays, Sedimentation, Diagenesis, Deposition (Sediments), Weathering, Estuaries, Sea water.

Large amounts of Al, Fe and Si carried in solution by fresh water may be chemically precipitated as hydroxide gels in the brackish water environment of estuaries and deltas. These gels are deposited in both the brackish water environment and in the neighboring seas, where they become parental material for the neoformation of clay minerals, and various other silicate and iron minerals. The type of neoformed minerals depends upon both the composition of the parental gels and the physico-chemical milieu of their crystallization. Evidence supporting this hypothesis is derived from: (1) the concentrations of Al, Fe and Si dissolved in fresh water and in sea water, (2) experimental work on the crystallization of aluminosiliceous gels, and (3) a study of the precipitation of Si from the waters of the Mississippi River delta. In earlier geological eras, when the world's river systems carried only relatively minor amounts of fine-grained continental detritus, this source of neoformed minerals is likely to have contributed a considerable proportion of the fine-grained sediments of these areas of sedimentation. (Knapp-USGS)
W72-04667

RECONNAISSANCE SAND INVENTORY: OFF LEEWARD MOLOKAI AND MAUI,
Hawaii Inst. of Geophysics, Honolulu.
J. F. Campbell, B. R. Rosendahl, W. T. Coulbourn, and R. Moberly, Jr.
Hawaii Institute of Geophysics Report HIG-71-17 (UNIHI-Sea Grant TR-71-02), October 1971. 51 p, 8 fig, 3 tab, 3 ref. NOAA Grant No 2-35-243.

Descriptors: *Sedimentation, *Sediment distribution, *Sedimentology, *Coasts, *Hawaii, Surveys, Islands, Analytical techniques, Particle size, Sands, Sediment yield.
Identifiers: *Molokai (Hawaii), *Maui (Hawaii), Seismic reflection.

The leeward coasts of the islands of Molokai and Maui, Hawaii were surveyed for shallow-water sand resources. Sediment deposits of 4 billion cubic yards were discovered using seismic reflection techniques. Twenty-four surface sediment samples collected during the survey indicate that much of the sediment is either finer or coarser than sand size. Analysis of the reflection records was made by tracing the bottom and all sub-bottom reflections, and then by picking the water depth and sub-bottom travel time at a set interval across the records. Much of the surface sediment of the central and western part of Molokai is very fine and even after discarding all but the sand-size material the median grain size is still lower than that required by the ASTM standards for concrete aggregate. Much of the surface sediment sampled off Maui had low percentages of sand-size material, and half of the samples were still too fine to meet the ASTM median grain-size standard. (Woodard-USGS)
W72-04668

THE CU, PB, ZN, MN, MO AND SB CONTENT OF STREAM AND SPRING SEDIMENTS, YORK COUNTY, NEW BRUNSWICK,
New Brunswick Dept. of Natural Resources, Fredericton. Mineral Resources Branch.
For primary bibliographic entry see Field 02K.
W72-04669

A STOCHASTIC MODEL OF BED LOAD TRANSPORT,
West Virginia Inst. of Tech., Montgomery. Dept. of Civil Engineering.
A. S. Paintal.
Journal of Hydraulic Research, Vol 9, No 4, p 527-554, 1971. 7 fig, 2 tab, 11 ref.

Descriptors: *Sediment transport, *Bed load, *Stochastic processes, Scour, Erosion, Turbulence, Variability, Alluvial channels, Shear drag, Statistical models.
Identifiers: *Stochastic models.

One of the most difficult problems encountered in alluvial channel hydraulics is the determination of rate of movement of bed material at low shear values by flowing water. The transport phenomenon has a high degree of randomness. The grains vary among themselves in shape and size as well as in their exposure to the flow. In addition, because of fluid turbulence the flow exhibits strong variations in time and space. The fundamental variables associated with low rates of transport are the variation in the exposure of the particles to the flow and the variation of hydrodynamic forces caused by turbulence. A distinct condition for the beginning of sediment movement does not exist. A bed load transport expression can be derived on the basis of a stochastic analysis which considers that the particle exposures are uniformly distributed, the turbulence is normally distributed, and the length of steps by particles follow a negative exponential distribution. (Knapp-USGS)
W72-04672

2K. Chemical Processes

ATOMIC ABSORPTION AND FLUORESCENCE SPECTROSCOPY WITH A CARBON FILAMENT ATOM RESERVOIR, PART V. DETERMINATION OF ELEMENTS IN ORGANIC SOLVENTS,
Imperial Coll. of Science and Technology, London (England). Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W72-04141

A COMPUTER-PROCESSED SEMI-AUTOMATIC TITRATOR FOR HIGH-PRECISION ANALYSIS,
Goteborg Univ. (Sweden). Dept. of Analytical Chemistry.
T. Anfalt, and D. Jagner.
Analytica Chimica Acta, Vol. 57, No. 1, p 177-183, November 1971. 1 fig, 1 tab, 4 ref.

Descriptors: *Computers, *Automatic control, *Automation, *Volumetric analysis, Research equipment, Laboratory equipment, Programming languages, *Analytical techniques, Water analysis.

A mini-computer-processed, semi-automatic titrator equipped with an analog scanner, a digital voltmeter, and a 16-bit relay register is described. The computer is a Hewlett-Packard HP2114B equipped with a core memory of 8,192 words of 16 bits. The scanner has 100 channels available for input volt-

age and the voltmeter can measure signals in the range 0d100 V at a maximum rate of 20 readings per sec. The relay register can be used to process simultaneously a maximum of 16 motor-driven syringe burets independently of each other. The titrator can be programmed in Assembler, Fortran and Basic. A major principle behind the design of the titrator is simplicity in programming, and this is achieved by the use of Basci callable subroutines to all peripheral equipment e.g. scanner, voltmeter and relay register. The titrator is therefore especially suitable for use in the research analytical laboratory, or may be used by the routine laboratory. Since the computer is easy to program optimization of different titration procedures should be easy. The titrator is equipped with a large number of input and output channels so that several analyses may be run in parallel. (Jefferis-Battelle)
W72-04152

A GAS CHROMATOGRAPHIC METHOD FOR THE DETERMINATION OF LOW CONCENTRATIONS OF THE CHLORIDE ION,
Birmingham Univ. (England). Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W72-04153

ELECTROCHEMICAL BEHAVIOR OF THE BORON ANODE IN AQUEOUS SOLUTIONS,
National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
For primary bibliographic entry see Field 01B.
W72-04173

CHLORIDE SEGREGATION ALONG GRAIN BOUNDARIES IN ICE,
National Center for Atmospheric Research, Boulder, Colo.
For primary bibliographic entry see Field 02C.
W72-04178

THE EFFECT OF IMPURITIES ON THE SURFACE STRUCTURE OF EVAPORATING ICE,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02C.
W72-04180

MISCIBLE DISPLACEMENT OF AMMONIA IN SOIL; DETERMINING SORPTION ISOTHERMS,
California Univ., Davis. Dept. of Water Science and Engineering.
D. E. Rolston, D. R. Nielsen, and J. W. Biggar.
Soil Science Society of America Proceedings, Vol 35, No 6, p 899-905, November-December 1971. 11 fig, 1 tab, 16 ref.

Descriptors: *Sorption, *Ammonia, *Ion transport, Adsorption, Soil chemistry, Fertilizers, Translocation, Ions, Ion exchange.

Most techniques for evaluating the sorption characteristics of anhydrous ammonia use steady-state or equilibrium conditions without considering simultaneously-occurring mass flow, diffusion, and sorption of the ammonia gas. A miscible displacement technique entails the displacement of the atmosphere from over-dry soil columns with ammonia at flow velocities of approximately 100 cm per hr. Transient sorption isotherms calculated from miscible displacement experiments were compared with the measured steady-state and transient sorption isotherms for both adsorption and desorption. Isotherms relating the amount of sorption to the relative ammonia density were of the nonlinear form. Sorption constants are different for adsorption and desorption. (Knapp-USGS)
W72-04190

NUMERICAL APPROXIMATION OF CATION EXCHANGE IN MISCIBLE DISPLACEMENT THROUGH SOIL COLUMNS,
Utah State Univ., Logan. Dept. of Soil Science and Biometeorology.
S-H, Lai, and J. J. Jurinak.
Soil Science Society of America Proceedings, Vol 35, No 6, p 894-899, November-December 1971. 9 fig 1 tab, 10 ref.

Descriptors: *Cation exchange, *Soil chemistry, *Soil water movement, *Aqueous solutions, *Ion transport, Ion exchange, Translocation, Leaching.

The cation exchange process in soil columns during the miscible displacement of cation solutions was studied, using the assumption of equilibrium between the cation adsorbed and the cation in solution. The material balance equation that governs the miscible displacement of cations includes an exchange function and was solved by a finite difference method. This method is capable of solving the material balance equation whether a linear or nonlinear cation exchange isotherm defines the exchange reaction. The applicability of the model and method of solution was tested by conducting soil column experiments. The agreement between the numerical solution and the experimental values was good. (Knapp-USGS)
W72-04191

CALCIUM COMPLEXING AND THE ENHANCED SOLUBILITY OF GYPSUM IN CONCENTRATED SODIUM-SALT SOLUTIONS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
F. S. Nakayama.
Soil Science Society of America Proceedings, Vol 35, No 6, p 881-883, November-December 1971. 5 tab, 18 ref.

Descriptors: *Solubility, *Gypsum, *Saline water systems, *Water chemistry, Calcium, Sodium, Sulfates, Chlorides, Nitrates, Aqueous solutions, Ions, Leaching, Saline soils, Soil chemistry, Soil water.
Identifiers: Complex ions.

Solubility of gypsum in NaClO4, NaCl, NaNO3, and NaOAc solutions and their mixtures was determined experimentally and theoretically. The dissociation constants of CaCl, CaNO3, CaOAc, NaOAc, and NaNO3 were computed from the solubility behavior of the solid. The predicted solubility values corresponded closely to the measured values in mixed Na-salt solutions when allowances were made for Ca-complexing. (Knapp-USGS)
W72-04194

CHANGE IN GROUND WATER U234/U238 ISOTOPIC RATIO AFTER TASHKENT EARTHQUAKE,
A. I. Spiridonov, and V. G. Tyminskiy.
Joint Publications Research Service No 53270, June 1971. 6 p, 1 fig, 1 tab, 11 ref. (Originally published in Izvestiya Akademii Nauk SSSR, Fizika Zemli, No 3, p 91-93, March 1971).

Descriptors: *Groundwater, *Earthquakes, *Radioisotopes, *Water analysis, *Boreholes, Analytical techniques, Gases, Uranium radioisotopes, Helium.
Identifiers: *Groundwater changes, Russia.

Data collected before and after the Tashkent, USSR earthquake of 1966 show that an increase in the radon concentration in mineral waters preceded the earthquake and the helium concentration in boreholes increased more than tenfold after the earthquake. Data are tabulated for the helium content and the value of the U234/U238 ratio in groundwater during periods preceding and following the Tashkent earthquake. The uranium isotopic ratios were determined using an 'Amur' spectrometer with a semiconductor detector. The layout of the boreholes over the area is shown. The observed change in the isotopic ratio is attributed to increased seismic activity in the region during and prior to the earthquake. (Woodard-USGS)
W72-04200

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE NUECES RIVER BASIN, TEXAS,
Geological Survey, Austin, Tex.
H. L. Kunze.
Texas Water Development Board Report 134, September 1971. 34 p, 8 fig, 5 tab, 34 ref.

Descriptors: *Water quality, *Surface waters, *Hydrologic data, *Chemical analysis, *Texas, River basins, Lakes, Reservoirs, Geology, Water pollution sources, Oil wastes, Oil industry, Streamflow, Rainfall-runoff relationships, Water chemistry, Data collections.
Identifiers: *Nueces River basin (Tex).

The kinds and quantities of minerals dissolved in su.face waters of the Nueces River basin in Texas are related principally to the geology of the area and to rainfall and streamflow characteristics; but industrial influences, particularly the disposal of oil-field brine, have affected the quality in some areas. The basin lies in two physiographic sections--the Edwards Plateau of the Great Plains province and the West Gulf Coastal Plain of the Coastal Plain province. The Edwards and associated limestones and the Glen Rose Limestone of Cretaceous age are exposed on the Edwards Plateau. Rocks exposed in the West Gulf Coastal Plain range in age from late Cretaceous to Holocene. Water in surface streams throughout the Edwards Plateau has a dissolved-solids content of less than 250 mg/liter. The principal constituents are calcium and bicarbonate. During low flow the water of streams in the West Gulf Coast Plain contains high dissolved-solids concentrations, in which sodium and chloride predominate. During the short periods of high flow, dissolved-solids concentrations are low and calcium and bicarbonate are the principal constituents. Lake Corpus Christi provides water of good quality for municipal supply, irrigation, and industrial use. (Woodard-USGS)
W72-04204

CHEMICAL ANALYSES OF GROUND WATER IN THE POWDER RIVER BASIN AND ADJACENT AREAS, NORTHEASTERN WYOMING,
Geological Survey, Cheyenne, Wyo. Water Resources Div.
W. G. Hodson.
Wyoming Department of Economic Planning and Development Basic-data Report, 1971. 20 p, 1 fig, 2 tab, 9 ref.

Descriptors: *Groundwater, *Water wells, *Water quality, *Chemical analysis, *Wyoming, Aquifers, Water utilization, Consumptive use, Water supply, Domestic water, Municipal water.
Identifiers: *Powder River Basin (Wyo).

A table of chemical analyses contains the results of 490 analyses of water from wells and springs from the Powder River Basin and adjacent areas in northeastern Wyoming. The analyses are tabulated by county, aquifer, and well number. The quality of a water is judged according to the use for which it is needed. Generally, the lower the dissolved solids, the better the water. For some uses, however, the concentration of particular constituents in a water may be more important than the total concentration of dissolved solids. The principal constituents analyzed, their characteristics, and recommended maximum concentrations for domestic and municipal use are given. The dissolved solids ranged from 58 to 30,000 mg/liter. (Woodard-USGS)
W72-04205

REACTIONS OF METAL IONS IN DILUTE AQUEOUS SOLUTION: HYDROLYSIS OF ALUMINUM,
Florida Univ., Gainesville, Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05F.
W72-04241

A COLORIMETRIC METHOD FOR THE DETERMINATION OF TRACE COPPER CONCENTRATIONS IN WATER,
Auburn Univ., Ala. Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W72-04325

GEOHYDROLOGY OF THE PICEANCE CREEK STRUCTURAL BASIN BETWEEN THE WHITE AND COLORADO RIVERS, NORTHWESTERN COLORADO,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04330

A COMPACT POTENTIOMETRIC SENSOR OF NOVEL DESIGN. IN SITU DETERMINATION OF PH, PS (2-), AND EH,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
M. Whitfield.
Limnology and Oceanography, Vol 16, No 5, p 829-837, September 1971. 5 fig, 21 ref.

Descriptors: *Chemical potential, *Oxidation-reduction potential, *Hydrogen ion concentration, *Instrumentation, Sea water, Water chemistry, Sulfides, Oxidation, Monitoring, Sampling, Bottom sediments.

A rugged, compact probe (2 cm overall diameter, 9 cm overall length) enables pH, pS (2-), and Eh to be measured in situ. A miniature glass electrode is mounted in an epoxy resin body to which the metal electrodes are cemented. The glass electrode is mercury filled and has a cylindrical sensing membrane. The probe is relatively insensitive to vibration and to changes in light intensity and the glass electrode equilibrates rapidly to temperature and pressure changes. Construction details are given. With appropriate holders the probe can be used for measurements in the water column, in the sediment, or in the intertidal zone. The performance of the unit is illustrated by data from a stagnant basin model and from an estuarine survey. (Knapp-USGS)
W72-04332

GEOLOGY, HYDROLOGY, AND QUALITY OF WATER IN THE MADERA AREA, SAN JOAQUIN VALLEY,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 02F.
W72-04334

HYDROCHEMICAL AND HYDROLOGIC CRITERIA OF LOCAL RUNOFF (GIDROKHIMICHESKIYE I GIDROLOGICHESKIYE KRITERII MESTNOGO STOKA),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W72-04362

ASSOCIATION AND DISSOCIATION OF A HUMIC ACID FRACTION AS A FUNCTION OF PH,
Geological Survey, Denver, Colo.
R. L. Wershaw, and D. J. Pinckney.
Available from GPO, Washington, DC 20402 Price - $2.50. Geological Survey Research 1971, Chapter D, Professional Paper 750-D, p D216-D218, 1971. 2 fig, 1 tab, 11 ref.

Descriptors: *Humic acids, *Colloids, *Water chemistry, Hydrogen ion concentration, Gels, Particle size, Hydrosols (Dispersions), Soil chemistry.

A humic acid fraction isolated by gel-permeation chromatography forms stable aggregates of a variety of sizes in solution. The concentrations of the various molecular sizes are a function of pH. At pH 7 the system is monodisperse, consisting of particles having a radius of gyration of 9.1 A. (Knapp-USGS)
W72-04364

RELATION BETWEEN OXIDATION POTENTIAL AND THE OCCURRENCE OF IRON IN GROUNDWATER FROM THE CHICOT AQUIFER, LAFAYETTE, LOUISIANA,
Geological Survey, Baton Rouge, La.
L. D. Fayard.
Available from GPO, Washington, DC 20402, Price $2.50. Geological Survey Research 1971, Chapter D, Professional Paper 750-D, p D182-D186, 1971. 4 fig, 2 tab, 14 ref.

Descriptors: *Water chemistry, *Hydrogeology, *Louisiana, *Iron, Hydrogen ion concentration, Oxidation-reduction potential, Aquifer characteristics.
Identifiers: Lafayette (La).

A study was made of the relation of Eh (oxidation potential), pH, and iron concentration of water in the Chicot aquifer underlying Lafayette, La. The aquifer consists of two sands of Pleistocene age and contains a calcium magnesium bicarbonate water. Iron concentrations range from 0.71 to 7.0 mg/liter. Water in the lower of the two sands has higher alkalinity and hardness and lower sulfate content than has water in the upper sand. The iron in solution is in equilibrium with ferric hydroxide, but not with hematite or magnetite. The oxidation potentials range from +50 to +110 millivolts and agree with the values predicted for equilibrium with ferric hydroxide on the basis of determined iron concentrations. (Knapp-USGS)
W72-04371

RELATIONSHIP BETWEEN GROUND-WATER LEVELS AND QUALITY IN SHALLOW OBSERVATIONS WELLS, MUDDY CREEK BASIN, SOUTHEASTERN YORK COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, Pa.
D. J. Growitz, and O. B. Lloyd, Jr.
Available from GPO, Washington, DC 20402, Price $2.50. Geological Survey Research 1971, Chapter D, Professional Paper 750-D, p D178-D181, 1971. 3 fig, 2 tab, 1 ref.

Descriptors: *Water chemistry, *Water level fluctuations, *Pennsylvania, Observation wells, Monitoring, Water pollution sources, Recharge, Fertilizers, Leaching, Infiltration.
Identifiers: York County (Penn).

Data were collected from 13 shallow observation wells in York County, Pa. The trends of groundwater levels were directly related to specific conductance of shallow groundwater in the Muddy Creek basin. Specific conductance generally increases when groundwater levels rise and decreases when groundwater levels fall. The chemical constituents dissolved in the groundwater from these wells come from natural chemical weathering of the regolith and the solution of fertilizers during periods of groundwater recharge. (Knapp-USGS)
W72-04373

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE HOUSTON, TEXAS METROPOLITAN AREA, 1969,
Geological Survey, Houston, Tex. Water Resources Div.
For primary bibliographic entry see Field 07C.
W72-04381

SYSTEMS ANALYSIS OF METHODS FOR MEASURING TRACE DISSOLVED ORGANIC MATTER IN SEAWATER,
Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 05A.
W72-04382

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1966: PARTS 3 AND 4. OHIO RIVER BASIN AND ST. LAWRENCE RIVER BASIN.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04383

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1966: PARTS 12-16. NORTH PACIFIC SLOPE BASINS, ALASKA, AND HAWAII AND OTHER PACIFIC AREAS.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04384

USE OF THE COMPOSITION OF THE ABSORBED CATION COMPLEX TO RECONSTRUCT THE GEOCHEMICAL ENVIRONMENT OF FORMATION OF WEATHERED CRUSTS (OB ISPOL'ZOVANII SOSTAVA POGLOSHCHENNOGO KOMPLEKSA KATIONOV DLYA VOSSTANOVLENIYA GEOKHIMICHESKOY OBSTANO VKI PERIODA OBRAZOVANIYA KOR VYVETRIVANIYA),
Vsesoyuznyi Geologicheskii Institut, Leningrad (USSR).
O. F. Safonova.
Geokhimiya, No 1, p 101-106, January 1971. 2 fig, 3 tab, 5 ref.

Descriptors: *Geochemistry, *Cation exchange, *Weathering, *Mineralogy, Basalts, Clay minerals, Kaolinite, Montmorillonite, Equilibrium, Groundwater, Salinity.
Identifiers: *USSR, *Crust, *Cations, *Anions, *Peneplains, Goethite, Gibbsite, Chlorite.

The qualitative composition of the absorbed cation complex in weathered crusts can be used to determine their affiliation with a specific facies. By knowing the quantitative mineralogical composition of the crusts and the composition of the absorbed cation complex, it is possible, with the aid of experimental curves, to determine the concentration and cation composition of circulating solutions which were in equilibrium with the absorbed cations during the formation of the weathered profile. Three cross sections of a Lower Cretaceous weathered crust developed on basalts in a hot and moist climate were examined. The cross sections represent two genetic types of weathered crust: (1) weathered crust on a dissected peneplain; and (2) weathered crust on a low peneplain. Although the reconstruction of the cation composition of waters circulating in the crusts during the time of their formation cannot be accepted as absolutely reliable, the data used in the reconstruction are consistent and agree with the geochemical conditions of formation of the two types. (Josefson-USGS)
W72-04399

DETERGENTS IN WATER - A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.
For primary bibliographic entry see Field 05B.
W72-04438

MERCURY IN WATER-A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.
For primary bibliographic entry see Field 05B.
W72-04440

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1966: PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04442

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1966: PARTS 9-11. COLORADO RIVER BASIN TO PACIFIC SLOPE BASINS IN CALIFORNIA.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04443

EFFECT OF PH ON THE FORMATION OF CLAY MINERAL-PROTEIN COMPLEXES,
New Hampshire Univ., Durham. Dept. of Soil and Water Science.
For primary bibliographic entry see Field 02G.
W72-04445

MARINE CHEMISTRY,
For primary bibliographic entry see Field 05B.
W72-04488

CHEMICAL COMPOSITION OF ATMOSPHERIC PRECIPITATION IN THE NORTHEASTERN UNITED STATES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02B.
W72-04515

UTILIZATION OF MULL (FOREST HUMUS LAYER) IN GEOCHEMICAL EXPLORATION IN THE EMPIRE DISTRICT, CLEAR CREEK COUNTY, COLORADO,
Geological Survey, Washington, D.C.
G. C. Curtin, H. W. Lakin, A. E. Hubert, E. L. Mosier, and K. C. Watts.
Available from GPO, Washington, D.C. 20402 - Price $0.30 cents (paper cover). Geological Survey Bulletin 1278-B, 1971. 39 p, 25 fig, 3 tab, 18 ref.

Descriptors: *Geochemistry, *Mineralogy, *Metals, *Forests soils, *Colorado, Humus, Rocky Mountain region, Gold, Copper, Molybdenum, Data collections, Histograms, Soils, Surveys, Trees, Leaves, Exploration, Geology, Leaching.
Identifiers: *Clear Creek Co. (Colo), Mineral prospecting, Mull, Anomalies.

Results of geochemical studies in the Empire district, Clear Creek County, Colo., show that the distribution of anomalously high amounts of gold, copper, and bismuth in mull (forest humus layer) reflects the known distribution of these metals in bedrock beneath an extensive cover of colluvium and glacial drift; but their distribution in the transported soil that underlies the mull poorly delineates the distribution of the known metal deposits. High anomalies of silver, lead, zinc, and molybdenum in the mull encircle the principal anomalies of gold, copper, and bismuth and may reflect enrichment of silver, lead, zinc, and molybdenum in the bedrock beneath the colluvial and morainal cover. The high anomalous concentrations of gold, copper, bismuth, silver, lead, zinc, molybdenum, tin, and tungsten detected in the mull ash and the detection of these metals (except tungsten) in the ash of pine and aspen trees may reflect a geochemical cycle in which these metals are leached from the bedrock, are absorbed by the trees, and then in part deposited in the leaves and needles; they are finally concentrated in the mull as the leaves and needles decay. Some areas anomalously high in certain metals in mull are not related to known mineralization and merit further investigation. (Woodard-USGS)
W72-04516

THE PROTON AFFINITY OF WATER,
Rice Univ., Houston. Dept. of Chemistry.
For primary bibliographic entry see Field 01A.
W72-04533

INTERLABORATORY QUALITY CONTROL STUDY NO. 1 - CALCIUM, TOTAL HARDNESS, SODIUM AND POTASSIUM,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 05A.
W72-04542

OXYGEN ELECTRODE AND ITS BIOLOGICAL APPLICATIONS,
Wyoming Univ., Laramie. Dept. of Bioengineering.
For primary bibliographic entry see Field 05A.
W72-04543

CHEMICAL NATURE OF ORGANIC COLOR IN WATER,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05F.
W72-04589

WORLD-WIDE DISTRIBUTION OF MANGANESE NODULES,
Lamont Geological Observatory, Palisades, N. Y.
For primary bibliographic entry see Field 02J.
W72-04653

WATER RESOURCES DATA FOR KANSAS - 1970: PART 2. WATER QUALITY RECORDS.
Geological Survey, Lawrence, Kans. Water Resources Div.
For primary bibliographic entry see Field 07C.
W72-04660

INDEX OF SURFACE WATER STATIONS IN TEXAS - OCTOBER 1971.
Geological Survey, Austin, Tex. Water Resources Div.
For primary bibliographic entry see Field 07C.
W72-04662

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1967, PARTS 1 AND 2. NORTH ATLANTIC SLOPE BASINS AND SOUTH ATLANTIC SLOPE AND EASTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07C.
W72-04663

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1966: PARTS 1 AND 2. NORTH ATLANTIC SLOPE BASINS AND SOUTH ATLANTIC SLOPE AND WASTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04664

THE NEOFORMATION OF CLAY MINERALS IN BRACKISH AND MARINE ENVIRONMENTS,
Sedgwick Museum, Cambridge (England).
For primary bibliographic entry see Field 02J.
W72-04667

THE CU, PB, ZN, MN, MO AND SB CONTENT OF STREAM AND SPRING SEDIMENTS, YORK COUNTY, NEW BRUNSWICK,
New Brunswick Dept. of Natural Resources, Fredericton. Mineral Resources Branch.
V. B. Austria, Jr.
Available from N B Dept of Nat Resources, Fredericton, Canada, Price $5.00. New Brunswick Department of Natural Resources Mineral Resources Branch Report of Investigation No 14, 1971. 18 p, 6 fig, 7 map, 2 tab, 16 ref.

Descriptors: *Trace elements, *Chemical analysis, *Sediments, *Alluvium, *Geochemistry, Hydrologic data, Data collections, Metals, Hydrogeology, *Copper, *Molybdenum, *Manganese.
Identifiers: Canada (New Brunswick), *Antimony, *Lead, *Zinc, *Lake George (New Brunswick).

A reconnaissance sampling of drainage sediments was carried out in the southern part of York County, New Brunswick, Canada during the summer of 1970. The geochemical survey was designed to obtain the regional distribution patterns of trace elements and establish criteria for their interpretation in relation to bedrock composition and secondary environment. Included are distribution of Cu, Pb, Zn, Mo, Mn, and Sb in stream and spring sediments. In addition to regional sampling, a detailed stream sediment and soil sampling program was made near the Lake George antimony deposits to gather information which may prove useful in the search for the metal elsewhere. The range of concentration (parts per million) of these elements found in stream and spring sediments were: Cu, less than 1 to 84; Pb, 2 to 210; Zn, 3 to 366; Mo, less than 1 to 70; Mn, 20 to 73,000; and Sb, less than 1 to 185. (Woodard-USGS)
W72-04669

LEACHING OF EUPHRATES SALINE SOIL IN LYSIMETERS,
Baghdad Univ. (Iraq).
G. A. Al-Nakshabandi, A. Alzubaidi, H. N. Ismail, F. Al-Rayhani, and E. Al-Hadithy.
Journal of Soil Science, Vol 22, No 4, p 508-513, December 1971. 3 fig, 1 tab, 5 ref.

Descriptors: *Leaching, *Soil chemistry, *Soil structure, *Gypsum, *Saline soils, Irrigation practices, Sulfates, Ion exchange, Ion transport, Lysimeters, Alkaline soils, Land reclamation.
Identifiers: Iraq.

A saline soil from Euphrates alluvium at Abu-Ghraib, Iraq, was leached in two lysimeters with river water. The changes in composition of the soils and of the leachates were measured as well as the hydraulic conductivity. The presence of gypsum prevents the soils becoming sodic as leaching (with irrigation water of favorable composition) proceeds. (Knapp-USGS)
W72-04677

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1967: PARTS 3 AND 4. OHIO RIVER BASIN AND ST. LAWRENCE RIVER BASIN.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04689

2L. Estuaries

RECENT TIDAL POWER INVESTIGATIONS IN THE BAY OF FUNDY,
Department of Energy, Mines and Resources, Ottawa (Ontario).
For primary bibliographic entry see Field 06B.
W72-04114

MARKETING, GENERATION AND TRANSMISSION ASPECTS OF A BAY OF FUNDY TIDAL POWER DEVELOPMENT,
National Energy Board, Ottawa (Ontario).
For primary bibliographic entry see Field 06B.
W72-04115

INDEX TO RESEARCH ON COASTAL AND ESTUARINE WATERS IN THE UNITED STATES,
Pacific Northwest Water Lab., Corvallis, Oreg.
George R. Ditsworth.

Available from the National Technical Information Service as PB-206 543, $3.00 in paper copy, $0.95 in microfiche. September 1967. 33 p, 10 tab, 10 ref. FWPCA Program 16070--09/67.

Descriptors: *Coasts, *Estuaries, Projects, *Water pollution, Water treatment, Waste disposal, Environment, Documentation.
Identifiers: *Marine environment, *Coastal regions.

This index describes more than 250 research projects on coastal and estuarine waters of the United States that were in progress during 1966 or are planned for the near future by governmental, academic, and private facilities. The projects encompass biological, chemical, geological, and physical aspects of the marine environment. The following information is listed for each project: (1) project title; (2) state where research is conducted or the state from which the study is conducted; (3) university or agency conducting the research; (4) principal investigator (s) and (5) the information source. Projects are grouped according to four coastal regions: Pacific Coast (California to Alaska), Gulf Coast (Texas to Florida), South Atlantic Coast (Georgia to Maryland), and North Atlantic Coast (Delaware to Maine). In each regional category, the projects are listed under subject headings: Biological Studies; Physical and Chemical Studies; Waste Disposal, Pollution and Water Treatment Studies; Multidiscipline Environmental Studies; and Research Projects Planned. Sources of information for this index were gathered from ten references. (See also W71-12704 and W71-12705).
W72-04209

LEGAL ASPECTS OF OWNERSHIP AND USE OF ESTUARINE AREAS IN GEORGIA AND SOUTH CAROLINA,
Georgia Univ., Athens. Inst. of Government.
For primary bibliographic entry see Field 06E.
W72-04348

BASE FLOW AS AN INDICATOR OF AQUIFER CHARACTERISTICS IN THE COASTAL PLAIN OF DELAWARE,
Geological Survey, Dover, Del.
For primary bibliographic entry see Field 02F.
W72-04365

COASTAL GROUND-WATER FLOW NEAR PONCE, PUERTO RICO,
Geological Survey of Puerto Rico, San Juan.
For primary bibliographic entry see Field 02F.
W72-04366

THE ANTISYMMETRIC DIURNAL TIDE,
Centre National de la Recherche Scientifique, Paris (France). Service d'Aeronomie.
J. E. Blamont, and H. Teitelbaum.
Available from NTIS, Springfield, Va. 22151 as No. N71-31037 $3.00 paper copy; 95 cents microfiche. NASATechnical Translation TT-F-13, 817, November 1970. 10 p, 5 fig, 1 tab, 9 ref. (Translation of 'La Maree Diurne Antisymetrique', in Annales de Geophysique, Vol 24, No 2, p 381-385, 1968).

Descriptors: *Estuaries, *Tidal waters, *Tides, *Diurnal, *Forecasting, Mathematical studies, Equations, Analytical techniques.
Identifiers: Diurnal tides, Hough functions.

A rapid and precise method for solving the Laplace tidal equations takes into account the different duration of the solar and sidereal day in calculating the oscillatory modes of antisymmetric diurnal tide. The ensemble of these functions (Hough) is complete, with each mode shown to be associated with one of these functions. The variations of tidal mode can be deduced from their equivalent depths with altitude. (Woodard-USGS)
W72-04397

EVALUATION OF RECREATIONAL AND CULTURAL BENEFITS OF ESTUARINE USE IN AN URBAN SETTING,
Hofstra Univ., Hempstead, N.Y. Center for Business and Urban Research.
For primary bibliographic entry see Field 06B.
W72-04421

PHYSICAL PROCESSES OF WATER MOVEMENT AND MIXING,
For primary bibliographic entry see Field 05B.
W72-04487

HEAVY METAL CONCENTRATION IN COASTAL WATERS,
Liverpool Univ. (England). Dept. of Oceanography.
For primary bibliographic entry see Field 05B.
W72-04539

COMPUTATION OF GRAVITY CURRENTS IN ESTUARIES,
C. B. Vreugdenhil.
Available from NTIS, Springfield, Va. 22151 as N71-23606-$3.00 paper copy; $0.95 microfiche. Uitgeverij Waltman, Delft, Netherlands, 1971. 108 p, 36 fig, 10 tab, 63 ref, append.

Descriptors: *Estuaries, *Currents (Water), *Tidal waters, *Model studies, Stratified flow, Mathematical models, Saline water-freshwater interfaces, Engineering structures, Hydraulics.
Identifiers: Gravity currents.

A two-layer model (salt water-fresh water) is discussed concerning engineering applications devoted to gravity currents in estuaries. Although flow in most estuaries is not strictly stratified, the two-layer schematization can be useful. The two-layer model has mean velocities in each layer, and mixing in mean densities. These parameters can be applied to define a family of velocity and density profiles. Combined with a crude model of the turbulent structure, this gives realistic profiles. Therefore as an extension of the two-layer model an estimate of the velocity and density profiles can be given. The theory is verified by means of the 1956 measurements in the Rotterdam (Netherlands) Waterway. A satisfactory relationship was found, especially for the case without mixing. An estimate of the interfacial frictional coefficient as a function of the global conditions was obtained by a number of flume tests. (Woodard-USGS)
W72-04540

ESTUARINE MODELING: AN ASSESSMENT.
Tracor, Inc., Austin, Tex.

Copy available from GPO Sup Doc $4.50; microfiche from NTIS as PB-206 807, $0.95. Environmental Protection Agency, Water Quality Office Research Report 16070 DZW, February 1971, 497 p. EPA-WQO Project 16070 DZV 02/71.

Descriptors: *Estuaries, *Model studies, *Water quality, Water pollution, Intertidal areas, Mathematical models, Hydraulic models, Brackish water, Pollution abatement, Pollutants, Water quality control, Estuarine environment, Saline water.

A technical review and critical appraisal are presented of present techniques of water quality modeling as applied to estuaries. Various aspects of estuarine modeling are treated by a selection of scientists and engineers eminent in the field, and these essays are supplemented by discussions from technical conferences held during the course of the report's preparation. Topics discussed include mathematical models for estuarine hydrodynamics, water quality models of chemical and biological constituents, models of estuarine temperature structure, and the use of physical models in estuarine analysis. Also included is a review of solution techniques, viz. analog, digital and hybrid, a brief survey of estuarine biota and biological modeling, and a collection of case studies reviewing several estuarine modeling projects. Conclusions about the existing state of the art of estuarine modeling and recommendations for future research are summarized. (EPA abstract)
W72-04555

TRANSPORT EQUATION STABILITY AND ESTUARY MODELING,
Union Coll., Schenectady, N.Y. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 05B.
W72-04577

FLUSHING PATTERN OF CERTAIN TIDAL STREAMS IN DELAWARE,
Delaware Univ., Newark. Coll. ot Marine Sciences.
C. Daiber.
Available from the National Technical Information Service as PB-206 795. $3.00 in paper copy, $0.95 in microfiche. Completion Report, January 1972. 44 p, 4 fig, 15 tab, 6 ref. OWRR A-006-Del (3).

Descriptors: *Tidal waters, *Estuarine environment, *Water quality, *Nutrients, Tidal marshes, Salt marshes, Currents (Water), Streams, Eutrophication, Chemical analysis, Delaware, Path of pollutants.
Identifiers: *Flushing, Hydrographic data, Biological parameters, Tidal stream, *Broadkill River (Del), *Murderkill River (Del).

The flushing characteristics of two tidal streams, the Broadkill and Murderkill Rivers, have been established: (a) Current velocities and volumes of water transported per tidal cycle have been calculated. (b) Each stream can be divided into three segments along the longitudinal axis, a lower estuarine, upper estuarine and fresh water tidal. Each segment has its own salinity distribution, current velocities, tidal characteristics and flushing times. (c) These two streams do not display the two-layer system at all times that is typical of coastal plain estuaries; having a net seaward transport at all depths. Water quality characteristics of biological importance are described for the Broadkill River: (a) There is a longitudinal and seasonal distribution of the various forms of phosphorus and nitrogen, oxygen, pH and chlorophyll pigments. (b) The distribution of these various parameters is determined by the hydrographic features of the stream, the season and the location of one existing sewer outfall.
W72-04581

SELECTED BIBLIOGRAPHY ON THE ENGINEERING CHARACTERISTICS OF COASTAL INLETS,
California Univ., Berkeley. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 08A.
W72-04583

THE NEOFORMATION OF CLAY MINERALS IN BRACKISH AND MARINE ENVIRONMENTS,
Sedgwick Museum, Cambridge (England).
For primary bibliographic entry see Field 02J.
W72-04667

RECONNAISSANCE SAND INVENTORY: OFF LEEWARD MOLOKAI AND MAUI,
Hawaii Inst. of Geophysics, Honolulu.
For primary bibliographic entry see Field 02J.
W72-04668

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST CORROSION IN HOT SEA WATER,
Westinghouse Electric Corp., Pittsburgh, Pa.
N. Pessall, F. C. Hull, and C. Liu.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 - Price $0.75. Office of Saline Water, Research and Development Progress Report No 627, December 1970. 77 p, 43 fig, 6 tab, 22 ref.

Descriptors: *Iron alloys, *Desalination, *Corrosion, Electrochemistry, Sea water, Metals, Steel, Chromium, Cobalt, Molybdenum, Alloys.
Identifiers: *Pitting potential, *Anodic polarization, *Iron-base alloys, Tungsten, Rhenium.

Iron-base alloys, ranging from binary alloys of Fe-Cr to multicomponent alloys based on Fe-Cr-Mo, have been prepared by levitation melting. The relative resistances of the alloys to pitting corrosion in deaerated synthetic sea water, at temperatures up to 194 deg F, have been evaluated on the basis of critical pitting potentials, Ec, obtained from anodic polarization measurements. A new method for determining the Ec values is discussed which defines a discrete value of Ec for a given metal/environment system. Comparative immersion tests in ferric chloride solutions have shown excellent agreement with the relative resistances determined from electrochemical methods. The more highly resistant base alloys are Fe-Cr-W, Fe-Cr,Mo, Fe-Cr-Mo-Re and Fe-Cr-Mo-Co. In order to reduce the cost of these alloys, while retaining the corrosion resistance, combinations of elements have been successfully determined, based on electronic structure considerations, which can be substituted, wholly or partly, for the chromium, molybdenum, and cobalt components. It is concluded that by judicious selection of such substitutes, it should be possible to develop an economical ferritic steel with adequate mechanical and corrosion properties for use in hot sea water environments. (OSW abstract)
W72-04212

A TRACER STUDY OF PRESCALING DEPOSITION OF SCALE FORMING COMPOUNDS ON CONTROLLED SURFACES,
Atomics International, Downey, Calif.
H. L. Recht.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 - Price $0.50. Office of Saline Water, Research and Development Progress Report No 632, May 1971. 37 p, 2 fig, 3 tab, 27 ref. 14-01-0001-1681.

Descriptors: *Desalination, *Scaling, *Tracers, *Calcium sulfate, Inhibitors, Descaling, Rusting.
Identifiers: *Scale nucleation, *Calcium 45.

This study of the prescale deposition (adsorption) of calcium sulfate on 90-10 copper-nickel alloy surfaces uses radioactive calcium-45 as a tracer. Knowledge of the adsorption process preceding nucleation and scale deposition was shown to be the key to understanding the scale formation process; use of radioactive tracers provides a unique tool to gaining this knowledge. Experimentally, calcium sulfate was found to depend on pH, being greater at pH of 6.5 than at 4.5. Smooth surfaces were shown to inhibit scale formation. Adsorption of the calcium-45 species was enhanced by scale-inhibiting additives which act by complexing with the Ca+2 ion; it was reduced by those additives forming protective films on the metal surface. (OSW abstract)
W72-04213

APPLICATION OF IRON-ALUMINUM BASE ALLOYS TO SALINE WATER CONVERSION; PART II,
International Harvester Co., San Diego, Calif.
E. R. Duffy, and J. F. Nachman.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 0402 - Price $0.65. Office of Saline Water Research and Development Progress Report No 633, May 1971. 64 p, 42 fig, 7 tab, 8 ref. OSW Contract No. 14-01-0001-1796.

Descriptors: *Desalination, *Corrosion, *Aluminum alloys, *Iron alloys, Metallurgy, Crystallography, Sea water, Metals, Saline water, Surfaces.

Iron-aluminum base alloys were studied which retain resistance to sea water corrosion with minimum aluminum content, maximum ductility. Three best alloys determined by screening tests were subjected to velocities of 15 ft/sec at temperatures of 70 deg and 90 deg F. Final testing entailed exposure to sea water at 280 deg F in a pressurized autoclave. Molybdenum was found to have the most pronounced effect on improving corrosion resistance with chromium, copper and nickel having only second order effects. Overall, of the low-aluminum alloys tested the best ternary composition appeared to be 10 Al-4 Mo, the best quaternary 10 Al, 4 Mo, 2 Cu. Crystallographic ordering of high-aluminum alloys (14 to 16%) induced by appropriate heat treatments was found to improve corrosion resistance at levels of 25 to 33 percent order despite some localized corrosion at oxide laps. Chemical polishing improved all of the alloys investigated except 10 Al-4 Mo-2 Cu. The 10 Al-14 Mo composition showed the most significant improvement in corrosion resistance after chemical polishing with corrosion resistance superior to cupro-nickel. (OSW abstract)
W72-04214

CONVERSION OF DESALINATION PLANT BRINES TO SOLIDS,
Badger (W. L.) Associates, Inc., Ann Arbor, Mich.
F. C. Standiford.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 Price $1.25. Office of Saline Water Research and Development Progress Report No 636, October 1971, 118 p, 30 fig, 22 tab, 27 ref. OSW Contract 14-30-2660.

Descriptors: Brackish water, *Desalination processes, Crystallization, *Evaporators, Pretreatment (Water), *Brine disposal, Waste disposal, Byproducts, Costs, Heat exchangers, Evaluation, Flash distillation, Scaling.

Methods were studied of converting to solids the waste brines from multistage flash plants working on brackish waters. Feedwater treatment for maximum calcium removal is an inexpensive means of reducing brine waste volume to about 4% of product water volume. Crystallization of the salts in a multiple effect evaporator adds less than 10% to water cost, after credit for the additional water recovered. For a 2.5 mgd flash plant that would produce water for 85 cents where waste disposal was no problem, the extra feed treatment, evaporation to solids, and solids storage over a 30 year plant life would increase water cost to about 98 cents a thousand gallons. The crystallizing evaporator is very small. The tonnages and characteristics of the salts produced will usually not justify byproduct recovery for sale. Capital investment is much lower than for solar ponds but total annual costs are similar where solar conditions are favorable. A direct contact multi-stage flash process is proposed as a less expensive means of producing potable water and solids directly from some brackish water sources, characterized by having impurities mainly of calcium and magnesium sulfates. (OSW-abstract)
W72-04323

ION EXCHANGE: FIELD EVALUATION OF DESAL PROCESS,
Permutit Co., Princeton, N.J.
A. C. Epstein, and M. B. Yeligar.
For sale by: Supt. of Documents U.S. Government Printing Office, Washington, D.C. 20402 $2.50. Office of Saline Water, Research and Development Progress Report No 631, November 1970, 317 p, 37 fig, 32 tab, 16 ref. OSW Contract 14-01-0001-1288.

Descriptors: *Ion exchange, *Desalination processes, Pilot plant, *Brackish water, Arizona, New Mexico, Colorado, So Dakota, On-site tests, Costs, Estimated costs.
Identifiers: *DESAL process, Yuma (Ariz), Roswell (N.M.), Dalpra Farm (Col), Webster (S.D.).

Field evaluation of the DESAL ion exchange process was conducted at four sites, viz., Yuma, Arizona, Roswell, New Mexico, Dalpra Farm, Colorado, and Webster, South Dakota to establish design criteria, operating parameters and economics of the process. Problems with initial carbonation of the resin at Yuma site prevented acquisition of significant data. Successful operations are dependent upon the total dissolved solids, the cationic composition, the anionic composition, the use of softened water for regenerant dilution and rinsing and the degree of initial carbonation. The results of field tests showed that, for a given water to be treated by the DESAL process, laboratory or pilot plant studies should first be conducted to determine the operating characteristics of the system. These studies should simulate the operating techniques employed in the commercial unit so that a particular water can be optimized with respect to operating parameters. (OSW-abstract)
W72-04324

EVALUATION OF 75,000 GPD SEA WATER DESULFATING PILOT PLANT,
Mason-Rust, Inc., Lexington, Ky.
K. M. Garrison, and J. E. Gugeler.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price $1.75. Office of Saline Water Research and Development Progress Report No. 746, November 1971. 185 p, 39 fig, 10 tab, 14 ref. OSW Contract No. 14-01-0001-2178.

Descriptors: *Sea water, Ion exchange, *Evaluation, *Desalination, *Sulfates, *Pre-treatment (Water), Chlorides, Scaling, Economics, Pilot plants, PResins.
Identifiers: Desulfating, Barium chloride.

The operation was evaluated of a 75,000-GPD pilot plant using the continuous ion exchange desulfation process for removal of sulfates from sea water as settled barium sulfate. A commercial strongly acid nuclear sulfonic cation exchange resin was used to precipitate barium sulfate. Resin was separated by decantation and converted back to the sodium form by means of soluable barium chloride. Desulfated sea water was used as feed to multistage flash distillation plant which resulted in continuous scale free operation at 350 deg F and high concentration ratios. Operational problems and an economic evaluation are included. (OSW-Abstract)
W72-04353

THERMODYNAMIC PROPERTIES OF AQUEOUS SOLUTIONS AT HIGH TEMPERATURES,
Westinghouse Electric Corp., Pittsburgh, Pa.
For primary bibliographic entry see Field 01B.
W72-04354

NATIONWIDE STUDY OF HIGH MUNICIPAL WATER RATES,
Buttenheim Publishing Corp., Pittsfield, Mass.
William Q. Sorsby, and Elroy F. Spitzer.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

20402 Price $2.25. Office of Saline Water's Research and Development Progress Report No. 719, September 1971. 302 p, 2 fig, 64 tab. OSW Contract No. 14-01-0001-1817.

Descriptors: *Desalination, *Analysis, *Water costs, *Water distribution (Applied), Demineralization, Cost comparisons, Water rates, Public utilities, Water requirements, Municipal water, Water supply.

Public water supplies (population greater than 1,000) that price delivered water at $7.50 per first 10,000 gallons or greater are identified. This price was assumed to be a threshold value where desalination can be considered for the next increment of supply. The distribution of such high-priced water supplies is analyzed by state, population, age of present rates and official expectation of needs for future added supplies. A total of 1,174 high-rate water supply service areas was identified out of over 11,000 queries. High-rate areas were found almost everywhere but one half are concentrated in seven states. The East North Central region alone represents 24%. Fifty percent of all high-rate service areas serve only between 1,000 and 3,110 people. Officials of one-third of the high-rate areas expect to need additional supply and rate increases within 5 to 10 years. Recent rate increase areas are more likely to expect rate rises than older rate areas. (OSW-Abstract)
W72-04355

DEVELOPMENT OF ULTRATHIN MEMBRANES,
Gulf General Atomic, Inc., San Diego, Calif.
R. L. Riley, H. K. Lonsdale, L. D. LaGrange, and C. R. Lyons.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 Price $1.00. Office of Saline Water Research and Development Progress Report No. 386, January 1969. 89 p, 18 fig, 21 tab, 32 ref. 14-01-0001-1242.

Descriptors: *Reverse osmosis, *Membranes, *Permselective membranes, *Semipermeable membranes, Desalination, Pressure, Saline water, Separation techniques, Sea water, Brackish water.
Identifiers: *Ultrathin membranes, *Water flux, Composite membranes.

High-flux desalination membranes can be prepared by forming composites of a thin film and a porous support membrane. Composite membranes exhibited properties in reverse osmosis tests that are comparable or superior to those of modified cellulose acetate membranes of the Loeb-Sourirajan type. Membranes, notably those prepared with thin films of cellulose triacetate, rejected 99.9% of a 1% NaCl solution at 1500 psi. One-foot-wide porous support membranes have been prepared from mixtures of cellulose nitrate and cellulose acetate in a continous process. These membranes are solution-cast onto a paper belt; have properties similar to those of so-called molecular filters; and are equally acceptable when used as porous supports for thin films prepared by the Carnell-Cassidy technique. The water permeability of these porous membranes is very high and the pore size and porosity can be controlled. Methods for continuously casting the ultrathin film and incorporating it into composite membranes were investigated; most of these methods were set aside or abandoned as difficult or impractical. Operations requiring the movement or transfer of the thin film from one surface to the surface of the porous support membrane are difficult to control and, they are less practical than alternative methods. A preferred method developed for forming composite membranes is an 'integral method' in which the thin film is cast directly on the porous support membrane. Membranes with excellent reverse osmosis properties have been prepared in this way in a batch process. The composite membranes are prepared by blocking the pores of the support membrane with a suitable water-soluble material and applying the thin film by wetting the coated surface of the support membrane with a solution of the polymer to be applied. Excellent thin films of cellulose triacetate have been applied to porous support membranes by filling the pores with polyacrylic acid and casting from a chloroform solution.
W72-04574

U. S. PATENT ABSTRACTS AND INDEXES COVERING THE TECHNOLOGY OF DISTILLATION PROCESSES FOR SALINE WATER CONVERSION,
Oak Ridge National Lab., Tenn.
K. O. Johnsson.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price $1.00. Office of Saline Water Research and Development Progress Report No. 732, July 1971. 82 p. Agreement No. 14-30-2535.

Descriptors: *Desalination, *Distillation, Sea water, Brackish water, Patents, Abstracts, Bibliographies, Publications.

Abstracts are given for approximately 400 U.S. patents pertaining to the distillation process for converting sea water or brackish water to potable water. The abstracts are part of a computerized storage and retrieval system operated for the Office of Saline Water by the Oak Ridge National Laboratory. The patents are indexed by keywords, patentees, and patent numbers. (OSW Abstract)
W72-04575

THE FEASIBILITY OF OBTAINING A SOLID DRY BRINE EFFLUENT FROM DESALTING PLANTS AT INLAND LOCATIONS,
Struthers Energy Systems, Inc., Warren, Pa.
N. Ganiaris, H. Whightman, and R. Glasser.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price $0.75. Office of Saline Water Research and Development Progress Report No. 639, December 1970. 51 p, 17 fig, 8 tab, 9 ref. Contract No. 14-30-2662.

Descriptors: *Waste disposal, *Evaporators, Design, Operating costs, Capital costs, *Desalination, Distillation, Drying, Effluents, Desalination plants, *Brines.

Two systems for converting to dry solids the brine effluent from a 2.5 MGD MSF plant were studied. The proposed systems were crystallizer/evaporators and fluidized bed granulators. The unit cost of water will be increased 10 to 25 percent as a result of processing the brine effluent from inland MSF desalting plants. The incremental cost (7.29 cents - 22.80 cents per 1000 gallons of total product water from a 2.5 MGPD desalting plant) is a function of the salts concentration and composition. Both systems are technically and economically feasible. The choice between these two systems depends on the composition and concentration of the brine effluent from the desalting plant. Present technology will allow multi-effect crystallizer/evaporator plants to be increased in size up to capacities equivalent to processing the effluent from 10 MGPD desalting plants. Since the unit cost of water is related to the soils content of the brine effluent, other desalting processes which can achieve higher concentrations may have substantially improved domestics providing they do not have the scale problems associated with the MSF process.
W72-04576

THERMAL PROPERTIES OF SEA WATER,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 07C.
W72-04582

A MATHEMATICAL MODEL FOR EVALUATING THE POTENTIAL OF DESALTING,
Little (Arthur D.), Inc., Cambridge, Mass.; and Office of Saline Water, Washington, D.C.
For primary bibliographic entry see Field 06A.
W72-04703

3B. Water Yield Improvement

DEPLETIONS, LOSSES, AND GAINS ALONG THE PECOS RIVER FROM ALAMOGORDO DAM TO ACME GAGE, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 02E.
W72-04201

AQUATIC WEED CONTROL IN FISH PONDS WITH CHEMICAL METHODS,
Auburn Univ., Ala. Agricultural Experiment Station.
For primary bibliographic entry see Field 04A.
W72-04267

CHARACTERISTICS OF STREAMFLOW OF SMALL WATERSHEDS IN PENNSYLVANIA AND FACTORS THAT INFLUENCE IT,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 02E.
W72-04287

SANTA BARBARA PYROTECHNIC CLOUD SEEDING TEST RESULTS 1967-70,
North American Weather Consultants, Santa Barbara, Calif.
R. D. Elliott, P. St. Amand, and J. R. Thompson.
Journal of Applied Meteorology, Vol 10, No 4, p 785-795, August 1971. 8 fig, 5 tab, 9 ref.

Descriptors: *Cloud seeding, *Artificial precipitation, *California, *Weather modification, Rainfall simulators, Mountains, Methodology, Clouds, Instrumentation, Rain gages, Data collections, Meteorology, Radar, Computer models.
Identifiers: *Pyrotechnic candles, Santa Barbara Co. (Calif).

Tests of the effectiveness of ground-released pyrotechnics in enhancing precipitation in storms in Santa Barbara County, Calif., were conducted during three winter seasons (1967-70). A series of pyrotechnic candles of the LW-83 formulation were ignited just prior to and during the passage of convective bands over the seeding site, located on a 3500-ft mountain ridge in the Santa Ynez mountains. Over 60 recording raingages extending over an area of about 1500 sq mi provided the basic evaluation data. Soundings taken with a GMD-1 system just prior to band passage into the test area provided useful air mass documentation. When the overall precipitation is considered, including the between-band (not-seeded) component, the net increase is about 32%. Precipitation between bands was not significantly changed by seeding. A computerized seeding-area-of-effect model was employed to predict an envelope of areas of seeding effect for the various categories of seeded bands. (Woodard-USGS)
W72-04387

FORMATION OF A RAIN SHOWER BY SALT SEEDING,
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
K. R. Biswas, and A. S. Dennis.
Journal of Applied Meteorology, Vol 10, No 4, p 780-784, August 1971. 7 fig, 8 ref. 14-06-D-6796 Bur Reclam.

Descriptors: *Cloud seeding, *Artificial precipitation, *Sodium chloride, *Weather modification, *South Dakota, Methodology, Instrumentation, Data collections, Clouds, Meteorology, Radar.

Three hundred and fifty pounds of NaCl was released below one end of a line of stratocumulus clouds in a study of artificial precipitation in South Dakota. Cloud base was 9000 ft and cloud tops were at 15 to 18,000 ft above sea level. Cloud top temperature was near-2C and updraft speeds below the base were near 3 m sec. The resulting shower was monitored by radar with the total rainfall being estimated at 280 acre feet. No rain fell from the unseeded portion of the cloud line or from any other clouds within 50 mi. (Woodard-USGS)
W72-04388

MEASUREMENTS OF PRECIPITATION PARTICLES IN WARM CUMULI OVER SOUTHEAST TEXAS,
Texas A and M Univ., College Station. Dept. of Meteorology.
G. E. Klazura.
Journal of Applied Meteorology, Vol 10, No 4, p 739-750, August 1971. 10 fig, 7 tab, 7 ref. Contract 14-06-D-6469 Bur Reclam.

Descriptors: *Precipitation (Atmospheric), *Drops (Fluids), *Particle size, *Clouds, *Texas, Measurement, Sampling, Methodology, Aircraft, Meteorology.
Identifiers: *Foil-belt particle sampler, Cloud water content.

Precipitation particles greater than 250 microns were sampled in the upper regions of warm cumuli over southeast Texas using a foil-belt particle sampler. Drop sizes 1 mm in diameter were common, and 2 mm drops were occasionally found. The effect of cloud height on the precipitation characteristics was pronounced. Higher concentrations and broader distributions were found in the tallest clouds. The height of clouds played a more important role in determining drop concentration and size distribution range than updrafts or downdrafts. In a comparison between concentration of precipitation particles and average cloud water content (CWC), large quantities of drops were associated with low CWC. Conversely, large values of CWC were associated with small numbers of drops greater than 250 microns in diameter. (Woodard-USGS)
W72-04391

A CONTACT NUCLEATION MODEL FOR SEEDED CLOUDS,
Meteorology Research, Inc. Altadena, Calif.
A. J. Alkezweeny.
Journal of Applied Meteorology, Vol 10, No 4, p 732-738, August 1971. 7 fig, 9 ref. 14-06-D-6581 Bur Reclam.

Descriptors: *Cloud seeding, *Artificial precipitation, *Silver iodide, *Nucleation, *Model studies, Arizona, Summer clouds, Methodology.

A simple contact nucleation model for cloud seeding was developed, assuming that the clouds are seeded with an AgI acetone generator, and thatm the particles act only as contact nuclei. The model was run for cumulus clouds (typical of summer clouds in Flagstaff, Ariz) and the results compared well with observations. The model also shows that seeding near the cloud base is more effective than ground seeding. Several simplifications were used in this model such as constant updraft, liquid water content, and droplet sizes throughout the cloud. To have a realistic model, these parameters should be varied with height in a manner similar to that in clouds. (Woodard-USGS)
W72-04392

INTERBASIN TRANSFERS: DO WE NEED THEM,
Colorado Univ., Boulder. Dept. of Economics.
C. W. Howe.
Water Resources Bulletin, Vol 7, No 4, p 670-675, August, 1971. 7 ref.

Descriptors: *Inter-basin transfers, *Water supply, Cost-benefit analysis, Irrigation, Economic efficiency.
Identifiers: Agricultural surplus, Population dispersion.

The use of large-scale interbasin transfers is questioned by a discussion of some of the adverse impacts it may have and some alternatives. Large-scale interbasin transfers will mean substantial expansion of irrigated acreage since agriculture is the only sector capable of using water in sufficient quantities to consume the indicated amount, and since the provision of water to states along the diversion routes is probably essential for their cooperation. Combined with the highly inelastic demand for agricultural commodities within the United States, this expansion will either depress agricultural prices or displace other agriculture. Thus, substantial costs will be imposed on either the nation at large through mechanisms such as price supports or on specific areas which will be forced out of production. These costs are never considered in benefit-cost assessments. While demand changes may require some interbasin transfers, there are alternatives capable of supplying substantial amounts of water at lower cost than large-scale transfers. These alternatives include transfer of irrigation water to municipal use; reduction of conveyance losses; additional surface development; weather modification; wastewater reclamation; phreatophyte and riparian vegetative control; and desalting. (Settle-Wisconsin)
W72-04692

WATER DIVERSIONS TO THE NORTH AMERICAN PRAIRIES,
Texas Tech Univ., Lubbock. Dept. of Civil Engineering.
G. A. Whetstone, and E. W. Kiesling.
Water Resources Bulletin, Vol 7, No 4, p 684-688, August 1971. 18 ref.

Descriptors: *Diversion, *Supplemental irrigation, Economic feasibility, Water supply, Grasslands.
Identifiers: *North American prairies, Arctic watershed.

The North American prairies offer excellent opportunities for supplemental irrigation, and surplus waters appear to exist within economically justified transmission distances. The major purpose of diverting water to the prairies is for irrigation, although industrial and municipal uses would also be important. Being flat lands adaptable to mechanized agriculture and possessing a good transportation network, the prairies are well suited for such irrigation. Studies have indicated that the economic growth of the praire region depends crucially on the continued development of ground water irrigation which, in turn, depends upon water importation. Other studies have indicated that such importation to the high plains is economically feasible. For maximum feasibility, supplemental water should flow by gravity from the Rockies. Thus, the water sources under consideration lie in the Canadian Arctic watershed, requiring that the U.S. purchase Canadian water at the boundary. Further studies of the feasibility of water importation may well lead to importation projects economically beneficial to both the prairies and the Canadian areas of origin. (Settle-Wisconsin)
W72-04693

3C. Use of Water of Impaired Quality

PRESENT AND FUTURE SALINITY OF THE COLORADO RIVER,
Colorado River Board of California, Los Angeles.
M. B. Holburt, and V. E. Valentine.
Paper, American Society of Civil Engineers, Hydraulics Division, Specifications Conference, University of Iowa, Iowa City, Aug 1971. 32 p, 3 fig, 7 tab, 8 ref, append.

Descriptors: *Salinity, *Irrigation effects, *Salt balance, *Water utilization, *Water pollution, Dissolved solids, Irrigation water, Reservoir evaporation, Saline water, Depletion, Forecasting, Inflow, Damages, Salts.
Identifiers: *Colorado River Basin, Colorado River Compact, Upper Colorado River Basin, Lower Colorado River Basin.

Colorado River salinity causes severe problems for irrigators in California and Arizona, some in the Upper Colorado River Basin, and affects the urban areas in the southern California coastal plain. Continuing growth and development in the Colorado River Basin States will increase the river salinity substantially unless preventive measures are taken. Salinity of the river and its tributaries is caused by salts from natural and man-made sources, and by the consumptive use of water as it flows downstream. Irrigation is the predominant man-made activity that increases the river salinity. Evaporation from reservoirs and river surfaces, and phreatophyte losses also have a significant impact on the salinity of the river. The 1970 salinity report of the Colorado River Board concluded that a combination of salinity control projects would reduce the river salinity. Approximately 2.8 million tons of salt per yr could be removed from the river system if these control projects were constructed. (USBR)
W72-04106

CONJUNCTIVE USE OF SEA AND FRESH WATER RESOURCES: AN INTEGER PROGRAMMING APPROACH,
California Univ., Los Angeles. Dept. of Engineering Systems; and North American Rockwell Corp., Los Angeles, Calif.
For primary bibliographic entry see Field 06A.
W72-04700

SOME CONJUNCTIVE DESALTING STUDIES IN THE UNITED KINGDOM,
The Water Research Association, Marlow, (England); and University of Wales. Inst. of Science and Tech., Cardiff.
For primary bibliographic entry see Field 06D.
W72-04701

3D. Conservation in Domestic and Municipal Use

POTENTIAL TECHNOLOGICAL ADVANCES AND THEIR IMPACT ON ANTICIPATED WATER REQUIREMENTS.
National Academy of Sciences, Washington, D.C. Committee on Technologies and Water.
For primary bibliographic entry see Field 06D.
W72-04215

WHOLESALE COST ASPECTS OF WATER SUPPLY,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 06C.
W72-04250

MULTISTRUCTURED MUNICIPAL WATER DEMAND MODEL,
Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science.
For primary bibliographic entry see Field 06A.
W72-04257

EVALUATION OF RECREATIONAL AND CULTURAL BENEFITS OF ESTUARINE USE IN AN URBAN SETTING,
Hofstra Univ., Hempstead, N.Y. Center for Business and Urban Research.
For primary bibliographic entry see Field 06B.
W72-04421

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE SAN ANTONIO, TEXAS METROPOLITAN AREA, 1969,
Geological Survey, San Antonio, Tex.
For primary bibliographic entry see Field 07C.
W72-04535

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE BRYAN, TEXAS METROPOLITAN AREA, 1969,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 07C.
W72-04536

3E. Conservation in Industry

WATER IN THE ECONOMY OF THE JACKSON PURCHASE REGION OF KENTUCKY,
Geological Survey, Louisville, Ky.
R. W. Davis, T. W. Lambert, and A. J. Hansen, Jr.
Kentucky Geological Survey Special Publication 20, 1971. 33 p, 17 fig, 4 tab, 2 ref.

Descriptors: *Water resources development, *Surface waters, *Groundwater, *Hydrologic data, *Kentucky, Reviews, Water yield, Water quality, Rivers, Aquifer characteristics, Water wells, Water users, Chemical analysis, Tennessee River, Ohio River, Mississippi River.
Identifiers: *Jackson Purchase region (Ky).

The Jackson Purchase region of Kentucky contains an abundance of water. Surface-water supplies are available from the three large rivers that flow past the boundaries of the Purchase: the Tennessee, Ohio and Mississippi. In areas not adjacent to rivers groundwater supplies of 1,000 gpm or more can be obtained in most of the region. Water from most of the aquifers is commonly low in dissolved solids, soft, and about 59 deg to 60 deg F. The chemical quality of water from the rivers is good, with generally less than 300 ppm dissolved solids. The low-flow discharges are large and therefore capable of supplying water needs of a highly industrialized region and diluting properly treated waste material to low concentrations, even when rainfall is deficient. Economic growth of the region during the last 18 years has been mainly by large water-using industries. If more such industries locate in the Jackson Purchase to utilize the well-distributed groundwater and surface-water resources, the economy of the region should continue to grow and prosper. (Woodard-USGS)
W72-04520

PROCEEDINGS OF THE THIRD CANADIAN CONFERENCE ON PERMAFROST, 14 AND 15 JANUARY 1969.
For primary bibliographic entry see Field 02C.
W72-04521

PERMAFROST IN THE KNOB LAKE IRON MINING REGION,
McGill Univ., Montreal (Quebec). Sub-Arctic Research Lab.
For primary bibliographic entry see Field 02C.
W72-04522

3F. Conservation in Agriculture

ANIMAL WASTE UTILIZATION FOR POLLUTION ABATEMENT,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05B.
W72-04118

ECONOMIC APPRAISAL OF IRRIGATION SYSTEMS FOR THE GREEN RIVER BASIN, WYOMING,
Wyoming Univ., Laramie. Div. of Agricultural Economics.
R. J. Taggart, D. E. Agee, and R. T. Clark.
Agricultural Extension Service, Bulletin 548, June 1971. 30 p, 13 tab, 19 ref, append. OWRR A-002-WYO.

Descriptors: *Economic feasibility, *Wyoming, *Sprinkler irrigation, *Border irrigation, *Variable costs, *Fixed costs, *Total costs, Crop production, Investment, Taxes, Water requirements.

The economically depressed Green River Basin area of Wyoming was used to test the hypothesis that automated sprinkler irrigation would make development of arable land more economically feasible than if developed under the improved border-dike irrigation system. The sprinkler systems considered were the automated center-pivot type (one driven by hydraulic water power and the other by electric motors) as opposed to the improved border-dike surface system used on the Seedskadee Development Farm. To determine the economic feasibility of the systems, comparisons were made with regard to capital investment, operation and maintenance costs, irrigation costs affected by the system of irrigation including effects on income taxes, and the effects of hay yields. Total annual per acre costs for a surface irrigation system were lower than for all combinations of sprinklers and fields studied. Taking into account the effect on income taxes and the difference in expected yields, there was little difference in net returns after taxes between the systems. However, sprinkler systems have the advantage in terms of labor and water requirements and thus proved more economically feasible. Several data tables and diagrams illustrate the results. (Haugh-Wisconsin)
W72-04119

AQUATIC WEED CONTROL IN FISH PONDS WITH CHEMICAL METHODS,
Auburn Univ., Ala. Agricultural Experiment Station.
For primary bibliographic entry see Field 04A.
W72-04267

SPRAY IRRIGATION SYSTEM FOR TREATMENT OF CANNERY WASTES,
Campbell Soup Co., Camden, N.J.
For primary bibliographic entry see Field 05D.
W72-04315

THE EFFECT OF UNLINED TREATED SEWAGE STORAGE PONDS ON WATER QUALITY IN THE OGALLALA FORMATION,
Texas Tech. Univ., Lubbock. Water Resources Center.
For primary bibliographic entry see Field 05B.
W72-04349

BIOLOGICAL EFFECTS AND BEHAVIOR OF RADIOACTIVE FISSION PRODUCTS IN THE AGRICULTURE CHAINS,
Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow.
For primary bibliographic entry see Field 05C.
W72-04479

RENOVATION OF TREATED MUNICIPAL SEWAGE EFFLUENT AND DIGESTED LIQUID SLUDGE THROUGH IRRIGATION OF BITUMINOUS COAL STRIP MINE SPOIL,
Pennsylvania State Univ., University Park. Dept. of Forestry and Wildlife.
For primary bibliographic entry see Field 05D.
W72-04634

THE LOOK OF OUR LAND--AN AIRPHOTO ATLAS OF THE RURAL UNITED STATES: THE EAST AND SOUTH.
Economic Research Service, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04690

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

THE WALDECK II STATION.

Water Power, Vol 23, No 8, p 275-285, Aug. 1971. 11 p, 6 fig, 6 photo.

Descriptors: *Pumped storage, Construction, *Construction methods, *Tunnel construction, Reservoirs, Pressure tunnels, Rock bolts, Penstocks, Underground powerplants, Anchors, Tunneling machines, Extensometers, Excavation, Rockfill dams, Pump turbines, Tunnels, Foreign construction.
Identifiers: Chambers, German Federal Republic, West Germany, In-situ tests.

On the Eder River in West Germany, a 440-mw pumped-storage project is being constructed to absorb excess power in off-peak periods and produce energy to meet peak-load demands. Water will flow from the 4.6-million cu m capacity upper reservoir into the intake building and down a single 550-m long steel lined pressure tunnel. Water in the pressure tunnel will divide into 2 penstocks leading to 2 Francis pump turbines in the underground power cavern. Surge facilities will be provided by chambers at the power cavern end of a 500-m long tailrace tunnel. Water leaving the tunnel through the outlet works will flow into the 5.4-million cu m capacity lower reservoir. The 34-m wide, 106-m long, and 54-m deep (maximum) power cavern excavation began following in situ tests on 5 anchoring systems. About 950 anchors and 4000 rock bolts will be installed. Construction progress and plans are given for the pressure tunnels, penstocks, tailrace tunnel, surge chamber, reservoirs, and intake and outlet works. Commissioning of the first pump turbine at Waldeck ii is scheduled for September 1974. (USBR)
W72-04105

DEVELOPMENT OF SYSTEM OPERATION RULES FOR AN EXISTING SYSTEM BY SIMULATION,
Corps of Engineers, Dallas, Tex.; and Corps of Engineers, Davis, Calif.
C. P. Davis, and A. J. Fredrich.
Paper, American Society of Civil Engineers, Hydraulics Division Specifications Conference, University of Iowa, Iowa City, Aug 1971. 18 p, 3 plate

Descriptors: *Systems analysis, *Reservoir operation, *Simulation, Reservoirs, Systems engineering, Models, Computer models, Regulation, Reservoir stages.
Identifiers: Arkansas River Basin, White River Basin, Red River Basin, Water resources systems, Operating criteria, Computer applications.

Current operation rules for existing reservoir systems have evolved from combinations of operation rules developed for component reservoirs as single units. Consequently, the rules frequently do not permit full realization of the benefits of coordinated system operation. A simulation model has been developed to study a large existing water resource system on the Arkansas, White, and Red Rivers. The system was not previously amenable to comprehensive analysis. A program developed by the Hydrologic Engineering

Center, Corps of Engineers, Davis, California, was selected for the system study because it appeared to have the capability to consider most of the factors needed for developing operating rules for the system. Basically, the program enables the computer to perform a simulation study that in principle is no different from the routine studies performed in the past; the degree of refinement and complexity, and the speed of computations have been changed. Three simulation studies of alternative operation plans for the system have been completed. Preliminary guide curves have been developed from these simulations and additional regulation guides will be developed soon. Future studies are discussed. (USBR)
W72-04108

DEVELOPMENT AND EVALUATION OF CITIZEN PARTICIPATION TECHNIQUES FOR INLAND LAKE AND SHORELAND MANAGEMENT,
Huron River Watershed Council, Ann Arbor, Mich.
For primary bibliographic entry see Field 06B.
W72-04122

A TOPOLOGICALLY OPTIMUM WATER-SAMPLING PLAN FOR RIVERS AND STREAMS,
South Carolina Univ., Columbia. Dept. of Geology.
W. E. Sharp.
Water Resources Research, Vol 7, No 6, p 1641-1646, December 1971. 5 fig, 1 tab, 8 ref. OWRR S-020-SC and A-026-SC.

Descriptors: *Sampling, *Statistics, *Drainage patterns (Geologic), Topography, Streams, Rivers, Data collections, Networks, Monitoring.
Identifiers: *Topology.

It is postulated that the topologically optimum sequential sampling procedure for a stream network is to sample by successive elimination through division of the network at the centroid. The total number of samples is bounded by a minimum of log M and a maximum of 2 (1 + log M) where M is the link magnitude of the stream at the outlet. The results were used to develop a uniform sampling plan for the Edisto River in South Carolina. (Knapp-USGS)
W72-04162

WATER INFILTRATION CONTROL: A CHANNEL SYSTEM CONCEPT,
Nevada Univ., Reno. Dept. of Soil Science.
For primary bibliographic entry see Field 02G.
W72-04196

APPLICATION OF ANALOG COMPUTER FOR STREAMFLOW SYNTHESIS-PHASE I,
Nevada Univ., Reno. Center for Water Resources Research.
V. L. Gupta.
Available from the National Technical Information Service as PB-206 690, $3.00 in paper copy, $0.95 in microfiche. Completion Report, July 1971. 21 p, 7 fig, 4 tab. OWRR A-037-NEV (1).

Descriptors: *Streamflow forecasting, *Model studies, *Analog computers, *Flow rates, Water resources development, Methodology, System analysis, Input-output analysis, Hydrologic data, River basins, Computer models.

Based on a feasibility study, an improved rationale was developed which describes the temporal variability of daily and monthly streamflow sequences. Streamflow sequences are structurally expressed as the sum of mean flow, a selected number of harmonics as the deterministic component, and a time-lagged stochastic component. Mathematical models were examined for analogy with higher-order, damped differential equations. Analogy was extended to develop an Electric-Analog assemblage comprising potentiometers, summation circuits or inverters, and integrators. Individual segments of the analog assemblage reflect the mean, amplitude and phase of each of the harmonics, with a superimposed random noise generator. The principal feature of the random noise generated is its time-lagged Markovian property simulating the characteristics of the stochastic component. Digital computer models were developed for delineating the deterministic and stochastic components from a given time series. The models were compared to historic daily and monthly flow sequences of selected stations in the Truckee and Eel River basins. Results of analyses provide the input components for the Electric Analog. (Woodard-USGS)
W72-04207

A PROBABILISTIC MODEL FOR AN ANNUAL OPTIMUM CONTROL OF A COMPLEX RESERVOIR,
Bulgarian Academy of Sciences, Sofia. Inst. of Technical Cybernetics.
I. Tzvetanov.
International Symposium on Mathematical Models in Hydrology, July 26-31, 1971. Warsaw, Poland, Vol 1, Pt 2, p 807-817, 1 fig, 4 ref.

Descriptors: *Model studies, *Stochastic processes, *Probability, *Reservoir operation, Markov processes, Optimization, Flow, Input-Output analysis, Water control, Water demand.

An original approach for constructing a mathematical model for solving problems of the optimum control of a complex reservoir was presented. The mathematical description of the model required the following variables. The first was the input variable or the flow. The 24 hour flow was considered as a given season and could be described by a discrete Markov process. The second variable was the state of the reservoir or the discharge varying into the reservoir. The third was the output variable. The relative discharge evaporating in 24 hours was described as a simple stochastic process. The controlled output variables were characterized by the values of the demands for water consumption. To each consumer, a discharge was given. The fourth variable was the economic criteria for optimum control. Using the reservoir as a whole, a common goal was posed. The total and special goals depended on the economic characteristics which were included in the objective function. A penalty function was introduced. The recurrent equation of dynamic programming for optimum control at level n (l) was deduced. (Ligon-Cornell)
W72-04254

SOME PROBLEMS OF STOCHASTIC STORAGE WITH CORRELATED INFLOW,
Technical Univ. of Warsaw (Poland). Inst. of Environmental Engineering.
Z. Kaczmarek.
International Symposium on Mathematical Models in Hydrology, July 26-31, 1971. Vol 1 Pt 2, Warsaw, Poland, p 819-829, 1 fig, 8 ref.

Descriptors: *Stochastic processes, *Probability, *Reservoir operation, *Mathematical models, *Markov processes, Storage, Correlation analysis, *Model studies, *Reservoir storage.
Identifiers: *Moran's Method.

Dividing time, inflows, reservoir volumes and releases into a number of discrete intervals, a stochastic storage process was described using balance equations and functions defining the operating rules. Different methods were used for extending Moran's Method to include nonstationary and correlated inflows. The proposed method of analyses could be applied within a simulation model for evaluating the performance of any proposed reservoir operating policy. (Ligon-Cornell)
W72-04255

RESERVOIR OPERATING POLICY IN RELATION TO INFLOW PREDICTION,
Technical Univ. of Warsaw (Poland).
W. G. Strupczewski.
International Symposium on Mathematical Models in Hydrology, July 26-31, 1971. Vol 1, Pt 2, Warsaw, Poland, p 775-790, 8 ref.

Descriptors: *Stochastic processes, *Dynamic programming, *Probability, *Model studies, *Markov processes, Decision making, *Reservoir operation, Inflow, *Streamflow forecasting, Forecasting.

The possibility of considering a statistical inflow prediction in a process of making a reservoir management decision on the basis of a discrete stochastic model of dynamic programming was investigated. Markov processes were used. The model imposed a form of prediction which was not previously applied and consisted of (1) determining for each period the conditional distribution of the respective predictor vector (the condition being the state of the predictor vector in a preceding period); and (2) the determination of the conditional inflow distribution in each period on the basis of the state of the predictor. In exploitational practice, it appeared difficult to generalize about a dynamic model which considers an extended prediction. Two propositions were presented with the aim of enabling the use of extended prediction in a dynamic model at the cost of some simplification. The first was based on dealing with an agglomerated predictor related to the best inflow prediction in an actual period. The second proposition resulted from an observation that a single appearance of an extended prediction would not increase computational difficulties. Such procedure could be of practical value for reservoirs used for frequent water transition. (Ligon-Cornell)
W72-04258

STRIKING THE BALANCE,
National Science Foundation, Oak Ridge, Tenn. Environmental Program; and Oak Ridge National Lab., Tenn.
Eric Hirst, and Harvey Bank.
Environment, Vol 13, No 9, p 34-41, 1971. 6 fig, 16 ref.

Descriptors: *Aquatic weed control, *2-4-D, *Social aspects, Herbicides, Risks, Tennessee Valley Authority project, Benefits, Ecology, Water users, Mosquitoes, Reservoirs, Biocontrol, Political aspects, Economics, Aquatic weeds.
Identifiers: Melton Hill Lake (Tenn), Myriophyllum spicatum, Oak Ridge (Tenn).

Decisions concerning use of 2,4-D to control Eurasian watermilfoil are analyzed. This paper focuses on the scientific considerations in the risk-benefit analysis. By 1961 watermilfoil had spread throughout 1000 acres of the TVA system and the 2,4-D spraying program was a routine control method. However, a combination of dewatering and overwatering appears a good control method without producing ecological and public health problems but the TVA is reluctant to use this procedure because it interfers with multipurpose water uses. The heavy infestation risks involve depressed real estate values, limited recreational activities, clogged municipal and industrial water intakes, and development of extensive mosquito breeding areas. In high concentrations 2,4-D causes birth defects in mammals, genetic effects in plants, and may cause cancer. The City of Oak Ridge (Tennessee) uses the lake for recreation and drinking water. The director of Oak Ridge Public Health Department gained a postponement of the program and the TVA authorities decided not to spray in 1971. The situation points up the need for formal decisions complete with scientific explanations made public at an early data enabling the public and professional communities to participate in the risk-benefit analysis process. (Jones-Wisconsin)
W72-04265

AQUATIC WEED CONTROL IN FISH PONDS WITH CHEMICAL METHODS,
Auburn Univ., Ala. Agricultural Experiment Station.
J. M. Lawrence.
Available from the National Technical Information Service as AD-726 948, $3.00 in paper copy, $0.95 in microfiche. Army Corps of Engineers, Interagency Research Advisory Committee, Aquatic Plant Control Program, May 1967. 10 p, 2 tab, 10 ref.

Descriptors: *Aquatic weed control, *Fish hatcheries, *Chemcontrol, Aquatic algae, Plankton, Submerged plants, Floating plants, Plant groupings, 2-4-D, Laboratory tests, Toxicity, Herbicides.
Identifiers: *Fish ponds, Pond construction, Marginal weeds, Emersed weeds, Silvex.

A study of efficient and effective chemical control of aquatic weeds in fish ponds was made. Species of obnoxious plants were divided into planktonic and filamentous algae, submerged weeds, emersed weeds, marginal weeds, and floating weeds and their generic names included. The details of construction features of the ponds are given, since a pond properly constructed and fertilized supports a minimum of aquatic weed growth. Techniques by laboratory tests were developed for culturing submersed and emersed aquatic plants under artificial light at a constant temperature and for treatment of the weeds with a candidate herbicide. A total of 1500 different chemical compounds were evaluated by these methods. The 2,4-D and Silvex formulations and concentrations with their application rate ranges are given for bass, bluegill, and fathead. Shallow plastic pools were used for culturing communities of submersed, emersed, and floating weeds. The susceptibility (least to highest) of aquatic weeds to herbicides in these pools was of the same general order as that given for laboratory tests: alligatorweed, Pithophora, stargrass, Brazilian elodea, waterthread pond weed, southern naiad, common duckweed, water hyacinth. (Jones-Wisconsin)
W72-04267

COMPARATIVE LEAF STRUCTURE OF AQUATIC POLYGONUM SPECIES,
Virginia Polytechnic Univ. and State Univ., Blacksburg. Water Research Center.
Richard S. Mitchell.
American Journal of Botany, Vol 58, No 4, p 342-360, 1971. 21 fig, 1 tab, 13 ref. OWRR A-028-VA (4).

Descriptors: *Systematics, *Leaves, *Plant morphology, *Aquatic plants, United States, Laboratory tests, Greenhouses.
Identifiers: *Polygonum, Smartweeds, Leaf characteristics, Persicaria, Bistorta, Echinocaulon, Leaf anatomy.

Leaf morphology and anatomy of native Polygonum species which occur in water or on saturated substrates are studied systematically, treating 60 populations propagated in a common greenhouse. On the basis of this study American Polygonum species can be distinguished by leaf characters alone. Taxa in section Persicaria are contrasted and compared with representatives of sections Bistorta and Echinocaulon. A complete description utilizing 40 leaf characters, is given for each taxon. Complex glands, designated valvate chambers, are shown to be a consistent feature of the P punctatum species-complex, whereas epidermal storage-idioblasts are present only in certain populations of this group. All other species lack valvate chambers but possess idioblasts. The plate-like multicellular gland of P opelousanum is found to occur sporadically in P hydropiperoides, thereby losing its specific diagnostic value. Illucidation of the characteristic structure of this gland, however, lends evidence to discourage the theory that it is an abortive structure produced by a hybrid between glandular and non-glandular species. Reticulate venation and unicellular trichomes separate members of section Bistorta from the smartweeds, but P meisnerianum (section Echinocaulon) is shown to simulate leaf structure of the persicarias both internally and externally. (Jones-Wisconsin)
W72-04273

SEASONAL CHANGES IN THE PROXIMATE COMPOSITION OF SOME COMMON AQUATIC WEEDS,
Auburn Univ., Ala. Agricultural Experiment Station; and Agricultural Research Service, Fort Lauderdale, Fla. Crops Research Div.
Claude E. Boyd, and Robert D. Blackburn.
Hyacinth Control Journal, Vol 8, p 42-44, July 1970. 2 fig, 2 tab, 9 ref.

Descriptors: *Aquatic plants, *Proteins, *Feeds, Harvesting, Alligatorweed, Water hyacinth, Florida, Chemical analysis, Nitrogen, Nutrients, Cellulose, Foods, Forages, Leaves, Aquatic weeds.
Identifiers: Justicia americana, Crude protein levels, Alternanthera philoxeroides, Vallisneria americana, Hydrilla verticillata, Nuphar advena, Najas guadalupensis, Eichhornia crassipes, Pistia stratiotes.

In studying freshwater vascular plants as feedstuffs, a number of aquatic species could be dehydrated for fodder. To determine if care must be taken in timing the harvest of aquatic weeds, seasonal changes were investigated in the proximate composition of Alternanthera philoxeroides, Vallisneria americana, Hydrilla verticillata, Nuphar advena, Najas guadalupensis, Eichhornia crassipes and Pistia stratiotes. Samples of plant parts were taken from each strand and combined for chemical analysis. Since crude protein and true protein usually follow similar trends, crude protein levels reveal useful information about true protein content. No general trend of change in crude protein with maturity was obvious. The time of maximum harvestable crude protein was earlier than that of dry matter standing crop. The increase in amount of harvestable crude protein would compensate for decline in percentage crude protein in the dehydrated product. For efficient use of aquatic plants as feedstuffs, careful attention should be given to moisture content, crude protein, and dry matter standing crop. It may be desirable to adjust harvesting methods to obtain plant parts with the highest nutritive value. (Jones-Wisconsin)
W72-04274

PRECISION OF SAMPLING BY DOTS FOR PROPORTIONS OF LAND USE CLASSES,
North Carolina State Univ., Raleigh. Inst. of Statistics.
For primary bibliographic entry see Field 07B.
W72-04289

THE LOOK OF OUR LAND--AN AIRPHOTO ATLAS OF THE RURAL UNITED STATES: THE MOUNTAINS AND DESERTS.
Economic Research Service, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04338

HYDROLOGY AND SEDIMENTATION OF COREY CREEK AND ELK RUN BASINS, NORTH-CENTRAL PENNSYLVANIA,
Geological Survey, Washington, D.C.
L. A. Reed.
Available from GPO, Washington, DC - 20402 Price 25 cents. Geological Survey Water-Supply Paper 1532-E, 1971. 27 p, 13 fig, 8 tab, 15 ref.

Descriptors: *Streamflow, *Sediment transport, *Hydrologic data, *Agricultural watersheds, *Pennsylvania, Reviews, Water yield, Sediment yield, Agriculture, Vegetation, Seasonal, Water chemistry, Water quality, Rainfall-runoff relationships, Sediments, Particle size, Flow rates, Discharge measurement, Watershed management.
Identifiers: *Corey Creek Basin (Pa.), *Elk Run Basin (Pa.).

Analysis of data collected from two small agricultural basins in north-central Pennsylvania during the period May 1954 to September 1967 indicates that conservation measures reduced the quantity of suspended sediment leaving the Corey Creek basin during storms in the growing season. Extensive soil conservation treatments were applied in the 12.2-square-mile Corey Creek basin, but only minor treatments were applied in the adjacent 10.2-square-mile Elk Run basin. Treatments included the construction of ponds and diversion terraces and altering land use by such measures as establishing permanent hay land and changing marginal pasture land to wood lands. Elk Run basin, which is topographically and hydrologically similar to the Corey Creek basin, was used as an external control to assist in detecting and evaluating the hydrologic changes in Corey Creek. Trend analyses of data from both basins indicate a 47-percent decrease in sediment discharge from Corey Creek during the frequent storms that occur in the May to October growing season. Six percent of the sediment discharged from Corey Creek during the period of this investigation (1954-67) was discharged during these frequent growing-season storms. The remaining 94 percent of the sediment was discharged during the November to April dormant season and during two major events during the growing season, one October 1955 and one May 1961. No decrease in sediment discharge was observed for these events or for this period. (Woodard-USGS)
W72-04346

MULTIPLE LINEAR CORRELATION OF HYDROLOGIC FACTORS TO ESTIMATE MINIMUM FLOW (PRIMENENIYE MNOZHESTVENNOY LINEYNOY KORRELYATSII K OTSENKE FAKTOROV I RASCHETAM MINIMAL' NOGO STOKA),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
V. P. Gerasimenko.
In: Sbornik rabot po gidrologii, No 9; Gosudarstvennyy Gidrologicheskiy Institut, Leningrad, Gidrometeoizdat, p 52-61, 1970. 3 tab, 9 ref.

Descriptors: *Hydrologic data, *Correlation analysis, *Regression analysis, *Equations, *Low flow, Streamflow, Runoff, River basins, Forests, Saturated soils, Lakes, Seasonal.
Identifiers: *USSR, *West Siberian Lowland, *Ob River, *Minimum flow, Correlation coefficients, Regression coefficients, Regionalization.

The method of multiple linear correlation was proposed to compute summer minimum flow of rivers in the West Siberian Lowland. The basic factors responsible for summer minimum flow are: (1) size of basin area; (2) total moisture content of river basins described in terms of average annual streamflow; and (3) average basin altitude. The influence of waterlogged, forested and lake-surface areas on summer streamflow was negligible. Normal minimum flow was used as the dependent variable and the physiographic characteristics of the basins as independent variables. To illustrate the method proposed, minimum-flow factors were estimated for the Ob River Basin in the Lowland and an equation was obtained. The total correlation coefficient R was used as the criterion to identify homogeneous regions on the basis of minimum-flow formation conditions. Minimum flow computed by the equation agreed well with actual values. The equation derived may be recommended for hydrologic computations of summer runoff on ungaged rivers of the West Siberian Lowland. (Josefson-USGS)
W72-04361

CHANGES IN THE ELEVATION OF GREAT SALT LAKE CAUSED BY MAN'S ACTIVITIES IN THE DRAINAGE BASIN,
Geological Survey, Salt Lake City, Utah.
G. L. Whitaker.
Available from GPO, Washington, DC 20402, Price $2.50. Geological Survey Research 1971, Chapter D, Professional Paper 750-D, p D187-D189, 1971. 3 fig, 1 ref.

Descriptors: *Water levels, *Great Salt Lake, *Consumptive use, *Irrigation water, Evapotranspiration, Water management (Applied), Evaporation, Utah, Water level fluctuations.

The change in the surface elevation of Great Salt Lake caused by man's consumptive use of water in the drainage basin was calculated for each year since 1851, and the calculated changes were accumulated through 1965. The water-surface elevation of the lake in 1965 would have been 5.28 feet higher than the observed elevation had there been no consumptive use of water because of man's activities in the drainage basin. (Knapp-USGS)
W72-04370

ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN WISCONSIN,
Wisconsin Geological Survey, Madison.
D. H. Conger.
Geological Survey Open-file Report, 1971. 200 p, 21 fig, 2 tab, 12 ref.

Descriptors: *Flood forecasting, *Design flood, *Flood control, *Wisconsin, *Hydrologic data, Reviews, Mathematical studies, Equations, Regression analysis, Maximum probable flood, Streamflow, Stream gages.

Methods are provided for estimating flood characteristics of Wisconsin streams needed for planning and design, and flood data and related information available on the streams are summarized. Individual equations are presented for estimating flood discharges for selected recurrence intervals up to a 25-yr flood for drainage areas 0.5 sq mi and larger, a 50-yr flood for drainage areas 50 sq mi and larger. A ratio method is used for estimating a 50-yr flood for drainage areas 0.5 to 20 sq mi. The equations were defined from multiple regression analysis of flood peak records and basin characteristics for 119 continuous-record gaging stations and 114 crest-stage partial-record stations in Wisconsin and adjoining States. Solution of a hypothetical problem is given for using the flood-frequency equations. Graphs are presented for solution of flood discharges on regulated streams where the formulas are not applicable. Flood-frequency characteristics (2-year flood to 100-year flood) and drainage basin characteristics for stations used in the multiple regression are presented. (Woodard-USGS)
W72-04380

HONEY HILL: A SYSTEMS ANALYSIS FOR PLANNING THE MULTIPLE USE OF CONTROLLED WATER AREAS,
Harvard Univ., Cambridge, Mass. Dept. of Landscape Architecture.
For primary bibliographic entry see Field 06A.
W72-04544

A CONTINUOUS STORAGE MODEL WITH ALTERNATING RANDOM INPUT AND OUTPUT,
Indian Inst. of Tech., Madras. Dept. of Mathematics.
For primary bibliographic entry see Field 06A.
W72-04547

PROBLEMS OF ENGINEERING HYDROLOGY (VOPROSY INZHENERNOY GIDROLOGII).
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W72-04678

ESTIMATION OF PROBABILITY DISTRIBUTION PARAMETERS OF ANNUAL STREAMFLOW IN THE USSR (OB OTSENKE PARAMETROV RASPREDELENIYA VEROYATNOSTEY GODOVOGO STOKA REK SSSR),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W72-04683

PATTERNS OF SUCCESSION OF DRY AND WET YEARS AS A BASIS FOR COMPUTING STREAMFLOW REGULATION (ZAKONOMERNOSTI CHEREDOVANIYA MALOVODNYKH I MNOGOVODNYKH LET KAK OSNOVA RASCHETOV REGULIROVANIYA RECHNOGO STOKA),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W72-04684

EFFECTS OF RESERVOIR OPERATING POLICY ON RECREATION BENEFITS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06D.
W72-04697

4B. Groundwater Management

A FINITE DIFFERENCE METHOD FOR UNSTEADY FLOW IN VARIABLY SATURATED POROUS MEDIA: APPLICATION TO A SINGLE PUMPING WELL,
Nevada Univ., Reno. Center for Water Resources Research.
For primary bibliographic entry see Field 02F.
W72-04163

GEOTHERMAL POWER,
J. Barnea.
Scientific American, Vol 226, No 1, p 70-77, January 1972. 8 photo.

Descriptors: *Geothermal studies, *Thermal powerplants, *Thermal water, *Streams, Reviews, Earth pressure, Pore pressure, Geophysics, Borehole geophysics, Thermal properties, Geysers, Hot springs, Subsurface waters.
Identifiers: *Geothermal energy.

Information is presented to describe the conditions and methods of exploiting geothermal energy (steam and hot water) in several geophysical environments throughout the world. Natural underground reservoirs of steam and hot water are being tapped on a significant scale. The heat of many geothermal reservoirs comes from a large body of molten rock that has been pushed up into the earth's crust from great depths by geologic forces. Where the hot water can escape through a fissure it begins to boil, and part of it flashes off as steam. The geothermal energy can be tapped by a well driven into the fissure or down to the porous layer. In 1904 the first electricity plant powered by tapped steam was built in a steam field in northern Italy now known as the Larderello field. Other projects of natural steam or hot water for power, industrial purposes and heating were developed in Japan, Hungary, the U.S.S.R., Iceland, New Zealand and esewhere. In the U.S. the first geothermal power plant, of 12,500-kilowatt capacity, was commissioned in 1960 on the Geysers field, which is by far the largest field yet discovered in the world. (Woodard-USGS)
W72-04172

GROUND-WATER RESOURCE OF THE BLUE GULCH AREA IN EASTERN OWYHEE AND WESTERN TWIN FALLS COUNTIES, IDAHO,
Idaho Dept. of Water Administration, Boise.
S. L. Chapman, and D. R. Ralston.
Idaho Department of Water Administration Water Information Bulletin No 20, November 1970. 36 p, 18 fig, 2 tab, 11 ref.

Descriptors: *Water resources development, *Groundwater, *Irrigation, *Water wells, *Idaho, Hydrogeology, Aquifers, Aquifer characteristics, Water yield, Water quality, Hydrologic data, Data collections, Transmissivity, Groundwater recharge.
Identifiers: *Blue Gulch Area (Idaho).

The groundwater resources study area in western Twin Falls and eastern Owyhee counties, Idaho includes approximately 300 square miles and is composed of three geographic features: the Sake River canyon, the Salmon Falls Creek canyon, and a rolling plain. Surface drainage is to the Snake River and Salmon Falls Creek. The evelopment of the groundwater resource has been primarily for irrigation. Approximately 33 producing irrigation wells have been drilled. Most wells are less than 1,000 feet deep. Transmissibility of the aquifers varies from 3,800 to 840,000 gallons per day per foot. The depth-to-water ranges from approximately 72 to 448 feet below land surface, and the yield-to-wells varies from 339 to approximately 3,000 gallons per minute. Water-level fluctuations show declines of from 3 to 17 feet per year for a long term period. Water-level declines for the period April 1969 to March 1970 were over 27 feet. Water levels have risen slightly in the northern portion of the study area. Most water is suitable for both domestic and irrigation usage. Only three wells do not meet U.S. Public Health drinking water standards. The Department of Water Administration has 70 active permits and licenses on file for a appropriation of groundwater in the Blue Gulch area. These permits represent a potential withdrawal of 409 cubic feet per second for the irrigation of 29,140 acres of land. The major development has occurred in the southeastern portion of the area. (Woodard-USGS)
W72-04175

APPLICATION OF BOREHOLE GEOPHYSICS TO WATER-RESOURCES INVESTIGATIONS,
Geological Survey, Washington, D.C.
W. S. Keys, and L. M. MacCary.
For sale by the Superintendent of Documents, U.S. Govt. Printing Office, Washington D. C. 20402 Price $1.75. Geological Survey Techniques of Water-Resources Investigations, Book 2, Collection of Environmental Data, Chapter E1, 1971. 126 p, 75 fig, 6 tab, 120 ref.

Descriptors: *Groundwater, *Borehole geophysics, *Wells, *Subsurface investigations, *Logging (Recording), Methodology, Drill holes, Drilling, Petrography, Instrumentation, Electrical well logging, Radioactive well logging.
Identifiers: *Logging techniques, Acoustic logging, Caliper logging, Temperature logging, Fluid-movement logging, Fluid-conductivity logging.

This manual is intended to be a guide for hydrologists using borehole geophysics in groundwater studies. The emphasis is on the application and interpretation of geophysical well logs. Logging techniques are described that have been utilized within the Water Resources Division of the U.S. Geological Survey, and those used in petroleum investigations that have potential application to hydrologic problems. Numerous examples of logs are used to illustrate applications and interpretation in various groundwater environments. The interrelations between various types of logs are discussed and the following aspects are described for each of the important logging techniques: principles and applications, instrumentation, calibration and standardization, radius of investigation, and extraneous effects. (Woodard-USGS)
W72-04203

CHEMICAL ANALYSES OF GROUND WATER IN THE POWDER RIVER BASIN AND ADJACENT AREAS, NORTHEASTERN WYOMING,
Geological Survey, Cheyenne, Wyo. Water Resources Div.
For primary bibliographic entry see Field 02K.
W72-04205

GEOLOGY OF THE COMPACTING DEPOSITS IN THE LOS BANOS-KETTLEMAN CITY SUBSIDENCE AREA, CALIFORNIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.

W72-04331

GROUND WATER IN SANTA BARBARA AND SOUTHERN SAN LUIS OBISPO COUNTIES, CALIFORNIA, SPRING 1968 TO SPRING 1969,
Geological Survey, Menlo Park, Calif. Water Resources Div.
J. W. Warner.
Geological Survey Open-file Report, August 30, 1971. 24 p, 7 fig, 3 tab, 7 ref.

Descriptors: *Groundwater, *Water wells, *Hydrologic data, *Data collections, *California, Water supply, Water yield, Water quality, Chemical analysis, Hydrogeology, Water level fluctuations, Pumping, Withdrawal, Groundwater recharge, Aquifers.
Identifiers: *Groundwater resources, *Santa Barbara County (Calif), *San Luis Obispo County (Calif).

Groundwater pumpage in Santa Barbara and southern San Luis Obispo Counties, California, changed only slightly from that of 1967. Pumpage was slightly greater in some areas and slightly less in others. However, Cuyama Valley subunit had a substantial decrease in pumpage---about 11,400 acre-feet. Water levels rose in most areas. This is attributed to recharge from the abnormally heavy precipitation that occurred during the storms of January and February 1969. The Santa Maria and Sisquoc subunits had the largest groundwater storage increase--about 63,000 acre-feet. The Santa Ynez subunit also had a substantial increase--about 27,000 acre-feet. Precipitation exceeded the long-term average. Precipitation at Santa Barbara was 30.52 inches, 170 percent of the 102-year average; precipitation at Santa Maria was 21.27 inches, 155 percent of the 84-year average. The sulfate and dissolved-solids content in most of the water samples were in excess of the limits recommended for drinking water by the U.S. Public Health Service (1962). A zone of high-nitrate concentration in groundwater surrounds the Santa Maria sewage-disposal plant, about 4 miles west of Santa Maria. Nitrate concentrations in the water from the wells sampled ranged from 40 to 56 mg/liter. There was no indication of intrusion of sea water along the coast. (Woodard-USGS)
W72-04339

GROUND-WATER RESOURCES OF MONTGOMERY COUNTY, PENNSYLVANIA,
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 02F.
W72-04345

THE EFFECT OF UNLINED TREATED SEWAGE STORAGE PONDS ON WATER QUALITY IN THE OGALLALA FORMATION,
Texas Tech. Univ., Lubbock. Water Resources Center.
For primary bibliographic entry see Field 05B.
W72-04349

RELATIONSHIP BETWEEN GROUND-WATER LEVELS AND QUALITY IN SHALLOW OBSERVATIONS WELLS, MUDDY CREEK BASIN, SOUTHEASTERN YORK COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, Pa.
For primary bibliographic entry see Field 02K.
W72-04373

RESULTS OF SUBSURFACE EXPLORATION IN THE MID-ISLAND AREA OF WESTERN SUFFOLK COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
J. Soren.
Long Island Water Resources Bulletin No 1, Suffolk County Water Authority, March 1971. 60 p, 6 fig, 6 plates, 3 tab, 22 ref.

Descriptors: *Water resources development, *Groundwater, *Water supply, *Water quality, *New York, Water yield, Withdrawal, Groundwater recharge, Hydrologic budget, Hydrologic data, Aquifers, Aquifer characteristics, Hydrogeology, Chemical analysis, Data collections, Future planning (Projected), Water users.
Identifiers: *Suffolk County (N Y), *Long Island (N Y).

The results of a program of test drilling and data collection in the mid-island area of western Suffolk Country, Long Island, New York show that the area is underlain by thick unconsolidated aquifers of moderate to high permeability, the water in the aquifers is of good quality for domestic and industrial uses, and that additional high-yield wells can be developed in the area. Groundwater pumping in the area has increased greatly to maintain adequate supplies for the growing population. In 1968, about 33 mgd was pumped, about 2.5 times the average pumpage in 1958. The water table in most of the area has declined significantly, mostly as a result of groundwater pumping. From 1903 to 1968, the water-table decline ranged from about 10 feet in the eastern and central parts of the area, to about 30 feet in the western part. Most of the decline apparently occurred in the last two decades. Part of the decline was caused by drought from 1962-66. The decline of the water table reflects the loss of 50-70 billion gallons of groundwater from storage. Groundwater levels will continue to decline in the area unless net groundwater withdrawals are decreased or recharge is increased. Declining groundwater levels will be accompanied by decreased stream and subsurface outflow toward the sea and by salt-water intrusion into the aquifer. (Woodward-USGS)
W72-04401

INFILL OF NUCLEAR RUBBLE CHIMNEYS BY GROUND WATER,
Teledyne Isotopes, Palo Alto, Calif.
For primary bibliographic entry see Field 05B.
W72-04451

GROUND-WATER RESOURCES OF CHAMBERS AND JEFFERSON COUNTIES, TEXAS,
Geological Survey, Houston, Tex.
For primary bibliographic entry see Field 02F.
W72-04517

GROUND-WATER RESOURCES OF CASS AND MARION COUNTIES, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02F.
W72-04518

DATA FOR WELLS IN THE MODESTO--MERCED AREA, SAN JOAQUIN VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Water Resources Div.
G. O. Balding, and R. W. Page.
Geological Survey Open-file Report, 1971. 122 p, 3 fig, 65 map, 4 tab.

Descriptors: *Water wells, *Hydrologic data, *Data collections, *Logging (Recording), *California, Groundwater, Water yield, Drawdown, Chemical analysis, Water users, Water levels, Depth.
Identifiers: *Water well inventory, *San Joaquin Valley (Calif).

Between September 1970 and May 1971, 859 wells were canvassed by the U.S. Geological Survey in the Modesto-Merced area which covers about 1,800 square miles in eastern Merced and Stanislaus Counties in the northeastern portion of the San Joaquin Valley, California. The locations of the wells are shown on maps. Tables of data include use of wells, depth of well, diameter of casing, yield, drawdown, and chemical analyses of water. In addition, a table lists the well numbers of over 1,600 wells in the area canvassed by the Survey in the last 20 years. (Woodard-USGS)
W72-04519

WATER IN THE ECONOMY OF THE JACKSON PURCHASE REGION OF KENTUCKY,
Geological Survey, Louisville, Ky.
For primary bibliographic entry see Field 03E.
W72-04520

EFFECTS OF AGRICULTURAL PRACTICES ON AQUIFERS,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 05C.
W72-04633

MATHEMATICAL ANALYSIS OF GROUND-WATER RECHARGE,
Arizona Univ., Tucson. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02F.
W72-04652

GROUND-WATER POLLUTION AND SANITARY LANDFILLS--A CRITICAL REVIEW,
Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W72-04654

WATER DIVERSIONS TO THE NORTH AMERICAN PRAIRIES,
Texas Tech Univ., Lubbock. Dept. of Civil Engineering.
For primary bibliographic entry see Field 03B.
W72-04693

4C. Effects on Water of Man's Non-Water Activities

STUDIES IN THE APPLICATION OF DIGITAL SIMULATION TO URBAN HYDROLOGY,
Hydrocomp International, Palo Alto, Calif.
For primary bibliographic entry see Field 02A.
W72-04123

THE EFFECTS OF LAND USE CHANGE ON THE HYDROLOGY OF AN URBAN WATERSHED,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 06B.
W72-04126

THE PEACHTREE CREEK WATERSHED AS A CASE HISTORY IN URBAN FLOOD PLAIN DEVELOPMENT,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
For primary bibliographic entry see Field 06B.
W72-04127

SEDIMENT TRANSPORT BY STREAMS IN THE SNOHOMISH RIVER BASIN, WASHINGTON, OCTOBER 1967-JUNE 1969,
Geological Survey, Tacoma, Wash. Water Resources Div.
For primary bibliographic entry see Field 02J.
W72-04337

METHOD OF RATING FLOW IN A STORM SEWER,
Geological Survey, Mineola, N. Y.
For primary bibliographic entry see Field 07B.
W72-04363

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE HOUSTON, TEXAS METROPOLITAN AREA, 1969,
Geological Survey, Houston, Tex. Water Resources Div.
For primary bibliographic entry see Field 07C.
W72-04381

RAINFALL-RUNOFF INVESTIGATIONS IN THE DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Denver, Colo.
D. D. Gonzalez, and G. L. Ducret, Jr.
Geological Survey Open-file Report 71003, September 1971. 27 p, 3 fig, 2 tab, 16 ref.

Descriptors: *Rainfall-runoff relationships, *Urbanization, *Colorado, *Storm runoff, Model studies, Routing, Stage-discharge relations, Unit hydrographs, Frequency analysis, Floods, Hydrographs, Data collections, Rational formula, Depth-area-duration analysis.
Identifiers: *Denver (Colo), *Urban hydrology.

Definition of the magnitude and frequency of floods on small urbanized watersheds in the Denver metropolitan area requires the collection and analysis of rainfall-runoff data needed to synthesize long-term runoff records from precipitation records. Hydrologic models and synthetic unit hydrographs are the primary analytical methods used in the study. Analytical applications of the rational method are also investigated. Dual-digital recorders provide the detailed records of rainfall and runoff required in a form convenient for computer translation and tabulation. (Knapp-USGS)
W72-04513

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE DALLAS, TEXAS METROPOLITAN AREA, 1969,
Geological Survey, Fort Worth, Tex.
For primary bibliographic entry see Field 07C.
W72-04661

4D. Watershed Protection

THE FLOOD PLAIN AS A RESIDENTIAL CHOICE-RESIDENT ATTITUDES AND PERCEPTIONS AND THEIR IMPLICATIONS TO FLOOD PLAIN MANAGEMENT POLICY,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
For primary bibliographic entry see Field 06B.
W72-04124

REMEDIAL FLOOD PLAIN MANAGEMENT AS THE FOCUS FOR AN EXPERIMENT IN INTERDISCIPLINARY TEAM RESEARCH,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
For primary bibliographic entry see Field 06B.
W72-04125

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

PLASMA CHROMATOGRAPHY OF THE POLYCHLORINATED BIPHENYLS,
Waterloo Univ. (Ontario).
F. W. Karasek.
Analytical Chemistry, Vol 43, No 14, p 1982-1986, December 1971. 6 fig, 2 tab, 16 ref.

Descriptors: *Chromatography, *Spectrometers, Chlorine, Analytical techniques, Pollutant identification.
Identifiers: *Polychlorinated biphenyls, *Plasma chromatography, Mass spectrometry, Plasmagrams, Electron capture gas chromatography.

The use of plasma chromatography in identification of polychlorinated biphenyls is described. PCB crystals weighing less than 0.1 mg were placed in the sample holder and heated slowly. When enough vapor was present to obtain an instrument response, the holder was removed and replaced with an empty one. Samples admitted in this manner could be used for several hours' data taking. Plasmagrams were taken about 30 minutes after introduction. Both positive and negative plasmagram patterns were obtained for PCB compounds containing 1 to 10 chlorine atoms. The plasmagrams gave characteristic qualitative data. Negative response increased with the degree of chlorine substitution of the PCB. A correspondence between relative electron-capture detector responses and the intensity of the PCB-ion complexes in the negative plasmagrams was observed. (Mortland-Battelle)
W72-04129

THE DETERMINATION OF TRACE ELEMENTS IN BRINE BY ATOMIC ABSORPTION,
Kansas State Geological Survey, Lawrence.
O. K. Galle.
Applied Spectroscopy, Vol 25, No 6, p 664-667, 1971. 5 tab, 4 ref.

Descriptors: *Brines, *Separation techniques, *Trace elements, Manganese, Iron, Cobalt, Copper, Heavy metals, Hydrogen ion concentration, Resins, Calcium, Magnesium, *Spectrophotometry, Chelation, Water analysis, Analytical techniques, Sodium, Pollutant identification.
Identifiers: *Atomic absorption spectrophotometry, Nickel, Zinc, Lead, Ammonium chloride, Ion-exchange resin, Strontium, Chemical interference, Sample preparation.

An atomic absorption technique is described for determining trace metals (Mn, Fe, Co, Ni, Cu, Zn, and Pb) and alkaline earths (Ca, Mg, and Sr) in brines. In separating metals for analysis, 200 ml of brine are passed through a column of Dowex A-1 chelating resin to concentrate the elements. Ammonium chloride is used to adjust the resin pH to 4.5, which allows the resin to retain trace metals while allowing sodium and other alkali metals to pass through. The metals are then eluted with 1N HCl to a final volume of 50 ml and their concentration determined by atomic absorption. The analysis for alkaline earths is similar. Trace elements were successfully extracted from 200 to 300 ml of solution in a single pass through resin. When compared to other methods, the ability to concentrate the elements into smaller volumes is of particular advantage. Another advantage, particularly for separating Ca, Mg, and Sr, is the removal of sodium interference. On the other hand, large concentrations of iron (100 ppm or greater) cause some problems in not allowing adequate concentration of the trace elements. (Mortland-Battelle)
W72-04130

NEGATIVE ION MASS SPECTRA OF SOME PESTICIDAL COMPOUNDS,
Agricultural Research Service, Beltsville, Md. Human Nutrition Research Div.
P. C. Rankin.
Journal of the Association of Official Analytical Chemists, Vol 54, No 6, p 1340-1348, November 1971. 24 fig, 1 tab, 15 ref.

Descriptors: *Carbamate pesticides, *Spectrometers, 2 4 5-T, Chlorine, *Pesticides, Analytical techniques, Ions, Spectrophotometry, Chlorinated hydrocarbon pesticides, *Carbamate pesticides, Pollutant identification.
Identifiers: *Negative ion mass spectrometry, *Mass spectrometry, Carbaryl, Banal, Bay 37344, Zutran, Bay 44646, Bay 39007, IPC, CIPC, Isolan, Dimetilan, Pyramat, Temik, Temik sulfoxide, Methyl parathion, Ethyl parathion, Dimethoate, Ronnel, Lindane, Bromine, Chemical interference, Mass spectra.

The negative ion mass spectra of several pesticidal compounds were studied to determine the suitability of this technique for structural analysis. A Perkin-Elmer-Hitachi RMU-6E mass spectrometer was used. Liquid samples were placed in the instrument with a heated glass inlet system; solids were inserted directly with a solids probe. High sample pressures (.000008 to .00003 torr) were necessary because the electron multiplier used has a gain of ca 2500. An accelerating voltage of 3.6 kv provided increased sensitivity but could not be used routinely because of high voltage arcing and the limited m/e range. The fragmentation patterns of the compounds studied were generally uncomplicated and were typified by a lack of rearrangement ions. However, the absence of a significant molecular ion presented a serious disadvantage, as in identifying classes of compounds. It is concluded that the negative ion technique might be useful for analyzing pesticide mixtures, particularly the carbamate compounds because of the relatively intense characteristic fragment ion present in most of the spectra. However, the presence of chlorine or bromine will probably cause difficulties. (Mortland-Battelle)
W72-04131

ANALYSIS OF BLENDS OF MIXTURES USING MULTIVARIATE STATISTICS,
Oregon State Univ., Corvallis.
S. C. Elliot, N. A. Hartmann, and S. J. Hawkes.
Analytical Chemistry, Vol 43, No 14, p 1938-1939, December 1971. 6 ref.

Descriptors: *Pollutant identification, *Gas chromatography, *Oil wastes, Computer programs, *Statistical methods, Chromatography, Analytical techniques, Waste identification.
Identifiers: *Mixtures, *Analysis of variance, Oil characterization, Oil spills.

A mathematical method is described for analyzing blends of essential oils, petroleum products, or other natural extracts by multivariate statistics. Library computer routines are used in the calculations. Original mixtures may be analyzed if a sufficient quantity of analytical data, such as are produced by chromatographic analysis, is analyzed. In using the method it is necessary to assume that the original mixtures blend linearly. Hypothetical blends of peppermint oils and hop oils computed from published data were analyzed by this method, and the origins of the original oils in blends of up to four oils were successfully determined and identified. It is suggested that the method is applicable to analysis of pollutant oil slicks. (Holoman-Battelle)
W72-04132

FERTILIZER NITROGEN: CONTRIBUTION TO NITRATE IN SURFACE WATER IN A CORN BELT WATERSHED,
Washington Univ., St. Louis, Mo. Center for the Biology of Natural Systems.
For primary bibliographic entry see Field 05B.
W72-04133

ACCUMULATION AND DISTRIBUTION OF CHLORINATED HYDROCARBONS IN CULTURES OF (CHLOROPHYCEAE),
Lund Univ. (Sweden). Dept. of Animal Ecology.
A. Sodergren.
Oikos, Vol 22, p 215-220, 1971. 7 fig, 1 tab, 20 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *Pesticide residues, *Algae, Chlorophyta, Chlorella, Toxicity, Water analysis, Absorption, Cultures, DDT, Analytical techniques, Biomass, Gas chromatography, Centrifugation, Pesticides, Bioassay, Distribution patterns, Chromatography, Growth rates, Pollutant identification.
Identifiers: *Chlorella pyrenoidosa, Lindane, p p'-DDE, Clophen A 50, Electron capture gas chro-

matography, Polychlorinated biphenyls, Biological magnification, Chlamydomonas, Metabolites, Haematocrit tube.

The accumulation and distribution of lindane, p,p'-DDE and Clophen A 50 (PCB) have been studied in continuous flow cultures of Chlorella pyrenoidosa Chick. In estimating the cell volumes of algae in the culture a technique has been developed using centrifugation in a modified haematocrit tube. The number of cells in the culture was calculated by calibrating the cell volumes versus the cell counts. Samples of algae, air, and water from within the culture system were analyzed for residues of the chlorinated hydrocarbon pesticides on a Varian Aerograph 204 gas chromatograph with an electron capture detector. It was found that: (1) Lindane was accumulated by the algae but was also distributed in the water and air of the culture. (2) p,p'-DDE and Clophen A 50 were taken up by the algae to a great extent and only a small part remained in the water. At the end of the experiments 82 percent and 88 percent respectively of p,p'-DDE and Clophen A 50 were accumulated by the algae. (3) In the experiements there were no disturbances of the growth rate of the cultured alga due to the presence of the test substance. The uptake and distribution of the pesticides within the culture system and the relationship between cell volumes and cell counts are shown graphically. (Holoman-Battelle)
W72-04134

A METHOD FOR THE DETECTION AND QUANTITATIVE ESTIMATION OF SUBLETHAL POISONING IN LIVING FISH,
Uppsala Univ. (Sweden). Inst. of Zoophysiology.
For primary bibliographic entry see Field 05C.
W72-04135

DETERMINATION OF TRACE CONCENTRATIONS OF MERCURY IN ENVIRONMENTAL WATER SAMPLES,
Du Pont de Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.
P. E. Doherty, and R. S. Dorsett.
Analytical Chemistry, Vol 43, No 13, p 1887-1888, November 1971. 1 fig, 1 tab, 4 ref.

Descriptors: *Spectrophotometry, Heavy metals, Electrolysis, Cathodes, Analytical techniques, Ions, Electrodes, Water analysis, Separation techniques, Pollutant identification.
Identifiers: *Mercury, *Atomic absorption spectrophotometry, Organomercurial compounds, Electrodeposition, Detection limits.

An atomic absorption method has been successfully applied to determine both ionic and organic forms of mercury in environmental water. The electrodes of a copper-coil cathode are immersed in a water sample adjusted to about 0.1 N with nitric acid. The solution is stirred magnetically and mercury is electrodeposited onto the cathode. Electrolysis for 90 minutes quantitatively deposits up to 50 mg of mercury. A number of electrodepositions may be done simultaneously with sufficient electrical power. After deposition, the copper coil is removed from the solution, rinsed with distilled water and acetone, and air dried. Mercury is then determined by flameless atomic absorption spectrophotometry with a mercury vapor discharge lamp. A mercury concentration of 0.1 ppb in a 50 ml sample is easily measured by this method. Lower concentrations can be determined with larger samples and longer electrodeposition times. The method is estimated to be accurate to plus or minus 10 percent in the 0.1 to 10 ppb mercury range. (Mortland-Battelle)
W72-04137

THE PRESENCE OF PETROLEUM RESIDUES OFF THE EAST COAST OF NOVA SCOTIA, IN THE GULF OF ST. LAWRENCE, AND THE ST. LAWRENCE RIVER,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
E. M. Levy.
Water Research, Vol 5, No 9, p 723-733, September 1971. 3 fig, 4 tab, 11 ref.

Descriptors: *Oil wastes, *Sea water, *Spectrophotometry, St. Lawrence River, Atlantic Ocean, Sampling, Ultraviolet radiation, Fluorescence, Filters, Separation techniques, Analytical techniques, Water analysis, Oily water, Filtration, Absorbance, Rivers, Waste identification, Pollutant identification, Path of pollutants.
Identifiers: Canada, Nova Scotia, Gulf of St. Lawrence, Chedabucto Bay, Bunker C oil, Oil residues, Sample preparation.

Following the grounding and breakup of an oil tanker in Chedabucto Bay, Nova Scotia, seawater samples were collected off the eastern Canada coast for estimation of Bunker C oil or similar residual petroleum. These samples were taken on three separate cruises. On the first cruise, a shipboard method of estimation was utilized. Samples were filtered through 0.45 millimicron millipore filters and the retained particulate oil was dissolved after drying in approximately 4 ml of spectro-analyzed n-hexane. The ultraviolet absorbance at 256 nm of the resulting extract was measured spectrophometrically and referenced to a series of n-hexane dilutions of a standard solution of Bunker C oil. For samples obtained on the second and third cruises, a fluorescence technique was used in the laboratory for analysis. Oil was extracted with carbon tetrachloride and an n-hexane extract was prepared. The ultraviolet absorption was measured at 456 nm, and the extracts diluted if greater than 0.1. Extracts were then excited at 310 nm and their fluorescence spectra were scanned. Results were compared with those from standard solutions of the oil. Low, but significant concentrations of oil were found in the Atlantic near Nova Scotia, in the Gulf of St. Lawrence, and in the St. Lawrence River. Chedabucto Bay contained significantly higher concentrations. (Mortland-Battelle)
W72-04139

ATOMIC ABSORPTION AND FLUORESCENCE SPECTROSCOPY WITH A CARBON FILAMENT ATOM RESERVOIR, PART V. DETERMINATION OF ELEMENTS IN ORGANIC SOLVENTS,
Imperial Coll. of Science and Technology, London (England). Dept. of Chemistry.
J. Aggett, and T. S. West.
Analytica Chimica Acta, Vol 57, No 1, p 15-21, November 1971. 5 fig, 2 tab, 7 ref.

Descriptors: *Solvent extraction, *Spectrophotometry, *Heavy metals, *Trace elements, Fluorescence, Absorption, Separation techniques, Analytical techniques, Water analysis, Spectroscopy, Copper, Chelation, Solvents.
Identifiers: *Organo metallic systems, Organic solvents, Atomic absorption spectrophotometry, Atomic fluorescence spectrophotometry, Carbon filament, Silver, Cadmium, Lead, Zinc, Detection limits, Sample preparation.

The behavior of the carbon filament atom reservoir in the atomic absorption and atomic fluorescence of trace metals (Ag, Cd, Cu, Pb, Zn) extracted from aqueous solutions into organic solvents (C6H6, CHC13, CC14, MIBK) by a variety of chelating agents (cupferron, dithiocarbamates, Dithizone, 8-hydroxyquinoline, thenoyltrifluoroacetone) is described. All measurements were made with a Perkin-Elmer Model 290B spectrophotometer coupled either with a Servoscribe recorder or a Tele-equipment Model D535 (storage) oscilloscope. The spectral sources were Perkin-Elmer or ASL hollow-cathode lamps. There is no restriction on the nature of the solvent as in flame-based techniques and the behavior of the organometallic systems is virtually identical to that of aqueous solutions of the metals. Only with the copper (II)-oxine system was a slightly anomalous behavior observed. The general technique may easily be applied with solvent extraction preconcentration systems. The detection limits by atomic absorption are .01 ppm for copper, .003 ppm for silver, .002 ppm for zinc, .005 ppm for cadmium, and .08 for lead. Detection limits using atomic fluorescence are .004 ppm for copper, .001 ppm for silver, zinc, and cadmium, and .01 ppm for lead. (Holoman-Battelle)
W72-04141

REMOVAL OF SULFUR IN ENVIRONMENTAL SAMPLES PRIOR TO GAS CHROMATOGRAPHIC ANALYSIS FOR PESTICIDE RESIDUES,
Agricultural Research Service, Gulfport, Miss. Plant Protection Div.
R. L. Schutzmann, D. W. Woodham, and C. W. Collier.
Journal of the Association of Official Analytical Chemists, Vol 54, No 5, p 1117-1119, September 1971. 5 fig, 1 tab, 7 ref.

Descriptors: *Gas chromatography, *Chlorinated hydrocarbon pesticides, *Organophosphorus pesticides, *Pesticide residues, Sulfur, Pesticides, Aldrin, Heptachlor, Copper compounds, Soils, Sediments, Water analysis, Analytical techniques, Chromatography.
Identifiers: *Chemical interference, Ethyl parathion, Methyl parathion, Malathion, Heptachlor epoxide, Lindane, Electron capture gas chromatography, Metabolites, Desulfurization, Chemical recovery, Chromatograms, Sample preparation.

In order to analyze environmental samples for pesticide residues the elemental sulfur, which is frequently present, must be removed to avoid interference in the analysis. Samples can be desulfurized by refluxing with non-activated Raney copper powder (copper-aluminum alloy). Up to 50 ppm elemental sulfur can be removed from a 1 ml. sample. Desulfurized samples of soil, sediment, and water extracts were analyzed for pesticide residues using an F and M Scientific Model 810 gas chromatograph with an electron capture detector. More than 80 percent of the chlorinated pesticides and 50 percent of the parathion and malathion were recovered from the desulfurized extracts. Sample chromatograms are included. (Holoman-Battelle)
W72-04142

DETECTION AND ENUMERATION OF IRON BACTERIA IN MUNICIPAL WATER SUPPLIES,
Wisconsin State Commission on Water Pollution, Madison.
L. A. Lueschow, and K. M. Mackenthun.
Journal of the American Water Works Association, Vol 54, No 6, p 751-756, June 1962. 1 fig, 2 tab, 5 ref.

Descriptors: *Water treatment, *Iron bacteria, *Iron oxides, *Distribution systems, *Wells, Wisconsin, *Water quality, Water pollution, Pollutant identification.

Iron bacteria are typically aerobic organisms, widely distributed in nature and commonly found in water habitats. Energy is derived from the oxidation of ferrous iron to the ferric state, and in the process, ferric hydrate is accumulated on the sheaths and cells of the organisms. When iron bacteria are numerous enough to create a nuisance, standard centrifuge methods reveal concentrations that may be counted or estimated. In normal circumstances this procedure is inadequate and a membrane filter technique has been developed to determine low concentrations quantitatively. A 25-mm filter with a pore size of 0.45 microns is used in a standard holder. Immersion oil is used in placing the filter between slide and coverslip. Enumeration is completed at 430 or 980 X magnification. This permits a relatively accurate enumeration. An additional advantage of this technique is the detection of other foreign material in the sample. In Wisconsin, of 76 municipal wells examined, 53 percent revealed iron bacteria at various concentrations. Generally, Gallionella sp occurred more regularly than Leptothrix 3p. and usually in

greater numbers. In Madison, 20 wells were examined and 13 revealed iron bacteria. Wells negative once were generally negative consistently. Occurrence of iron bacteria in distribution systems was generally under 100 per ml but two outlets contained 10 million organisms per ml (a fire hydrant and an unused tap). (Bean-AWWA)
W72-04143

SELECTION OF A METHOD TO DETERMINE RESIDUAL CHLORINE IN SEWAGE EFFLUENTS,
Illinois State Water Survey, Peoria. Water Quality Section.
S. Lin, D. L. Hullinger, and R. L. Evans.
Water and Sewage Works, Vol. 118, No. 11, p 360-364, November 1971. 8 tab, 11 ref.

Descriptors: *Analytical techniques, *Sewage effluents, Water analysis, Chlorine, Illinois, Halogens, Statistical methods, Chemical analysis, *Volumetric analysis, Waste identification, Pollutant identification.
Identifiers: *Starth-iodide titration, N N-diethyl-p-phenylene diamine, *Leuco crystal violet, Chlorine residual.

Residual chlorine in the effluents of three sewage works that serve Peoria, Morton, and Washington, Illinois, and in chlorine-demand-free water was determined by four methods: MSI (modified starch-iodide 'forward' titration), SIB (starch-iodide backward titration), DPD (N, N-diethyl-p-phenylene diamine) and LCV (leuco crystal violet). The purpose of this investigation was to determine which of the four methods would be most appropriate for determining residual chlorine in sewage effluents. Testing procedures basically involved dosing a sample to a calculated quantity of chlorine using stock solutions for varying contact periods and measuring the chlorine residual with different methods. A statistical analysis of all observed data was made using the t-test of pairing observations. The modified starch-iodide (MSI) method was chosen for the continuation of the sewage chlorination study because of its simplicity, speed and economy over the standard starch-iodide backward titration method and its dependability over the DPD and LCV methods. The DPD and LCV methods, although excellent for testing water, were found inapplicable in determination of residual chlorine in sewage effluents at the concentrations used in the testing procedures. With some modification they might be satisfactory for use with chlorinated sewage samples, especially the LCV method. All comparative data for the methods analyzed and the chemical characteristics of treated sewage effluents are presented in tabular form. (Holoman-Battelle)
W72-04148

MULTICHANNEL ATOMIC FLUORESCENCE AND FLAME PHOTOMETRIC DETERMINATION OF CALCIUM, COPPER, MAGNESIUM, MANGANESE, POTASSIUM AND, ZINC IN SOIL EXTRACTS,
Imperial Coll. of Science and Technology, London (England). Dept. of Chemistry.
R. M. Dagnall, G. F. Kirkbright, T. S. West, and R. Wood.
Analytical Chemistry, Vol. 43, No. 13, p 1765-1769, November 1971. 8 tab, 17 ref.

Descriptors: *Fluorescence, *Soils, *Spectrophotometry, Photometry, Calcium, Copper, Magnesium, Manganese, Potassium, Heavy metals, Separation techniques, Analytical techniques, Soil analysis, *Trace elements, Pollutant identification.
Identifiers: Atomic fluorescence spectrophotometry, Flame photometry, Zinc, Sample preparation.

Rapid, sensitive, and accurate analysis for trace metals in soil can be performed using a six-channel atomic fluorescence spectrophotometer. This technique allows virtually simultaneous determination of six elements. Ammonium acetate, acetic acid, or EDTA solution are used as extracting agents. The atomic fluorescence mode is used to determine calcium, copper, magnesium, manganese, and zinc, and flame atomic-emission spectrophotometry to determine potassium. Using this technique, all six elements can be determined in a single extract at two dilutions. Results of analyses using this technique were compared with single-channel atomic absorption determinations and were identical within experimental error. The advantage of the six channel technique is the time saved by the simultaneous determination. (Mortland-Battelle)
W72-04149

THE DETERMINATION OF SMALL AMOUNTS OF COPPER IN ORGANIC MATTER BY ATOMIC-ABSORPTION SPECTROSCOPY,
L. E. Coles, W. Cassidy, J. C. Gage, R. A. Hoodless, and E. M. Johnson.
Analyst, Vol. 96, p 741-743, October 1971. 8 ref.

Descriptors: *Copper, *Spectrophotometry, *Organic matter, Analytical techniques, Trace elements, Solvent extractions, Lipids, Foods, Heavy metals, Separation techniques, Pollutant identification.
Identifiers: *Diethylammonium diethyldithiocarbamate, *Atomic absorption spectrophotometry, Beverages, Fatty foods, Ammonium pyrrolidinedithiocarbamate, Detection limits, Sample preparation.

The Metallic Impurities in Organic Matter Sub-Committee has revised its 1963 recommendation for detection of small amounts of copper in organic matter. The previous recommended method involved the use of diethyl ammonium diethyldithiocarbamate. This method is still valuable for many analyses, but advances in atomic absorption spectrophotometry have made it quicker and easier to apply. Therefore, new recommendations are made for analysis of copper in ready-to-drink beverages, semi-solid foodstuffs, oils, fats, and fatty foods. Ammonium pyrrolidinedithiocarbamate (APDC) can be used for extraction of copper from a wide range of aqueous solutions into organic solvents suitable for direct atomic absorption spectrophotometry. Among the advantages of extracting the copper into an organic phase are: (1) the concentration of the metal may be 100 times greater, (2) the atomic-absorption signal is enhanced, and (3) the copper is separated from high concentrations of salts. The sensitivity of the method is generally between 0.02 and 0.1 ppm but with calibration curves and larger samples it can be used for amounts of between 0.2 and 1 microgram and between 20 and 100 micrograms of copper. (Holoman-Battelle)
W72-04151

A COMPUTER-PROCESSED SEMI-AUTOMATIC TITRATOR FOR HIGH-PRECISION ANALYSIS,
Goteborg Univ. (Sweden). Dept. of Analytical Chemistry.
For primary bibliographic entry see Field 02K.
W72-04152

A GAS CHROMATOGRAPHIC METHOD FOR THE DETERMINATION OF LOW CONCENTRATIONS OF THE CHLORIDE ION,
Birmingham Univ. (England). Dept. of Chemistry.
R. Belcher, J. R. Majer, J. A. Rodriguez-Vazquez, W. I. Stephen, and P. C. Uden.
Analytica Chimica Acta, Vol. 57, No. 1, p 73-80, November 1971. 4 fig, 2 tab, 5 ref.

Descriptors: *Gas chromatography, Analytical techniques, *Chlorides, *Solvent extraction, Halogens, Chlorine, Methodology, Distillation, Water analysis, Chromatography, Solvents, Separation techniques, Ions, Pollutant identification.
Identifiers: *Organomercury compounds, Flame ionization gas chromatography, Thermal analysis, Detection limits, Sample preparation.

It is possible to use gas chromatography to detect low levels of chloride ion in aqueous solutions if the chloride is volatilized. In the present study, chloride in aqueous solution was converted to volatile phenylmercury (II) chloride, extracted into chloroform, concentrated by distillation, and analyzed by a Pye 'series 104' gas chromatograph with a heated flame ionization detector. Tests have been run to verify the accuracy and precision of this method for 0.4 - 7.0 micrograms of chloride per millitliter ot chloroform extract. Levels of chloride to 0.008 ppm in aqueous solution were determined. Graphic data on phenylmercuryII chloride are included. The level of detection no doubt could be improved by the use of an electron capture detector, modified volumes of aqueous solution and organic extractant, and larger sample sizes. Holoman-Battelle
W72-04153

REMOTE SENSING OF SOUTHERN CALIFORNIA OIL POLLUTION EXPERIMENT.
Coast Guard, Washington, D.C. Pollution Control Branch.

Available from NTIS, Springfield, Va. 22151 as PB-203 194 $3.00 in paper copy; $0.95 in microfiche. Coast Guard Office of Research and Development Report, July 1971. 107 p.

Descriptors: *Water pollution, *Oily water, *Pollutant identification, *Remote sensing, *Analytical techniques, Spectroscopy, Radar, Aircraft, Oceans, Surface waters, Water pollution sources, Publications, Surveys, Reviews.
Identifiers: *Oil spills, Oil slicks.

The Coast Guard conducted a controlled oil spill test off the Coast of Southern California in October 1970 to evaluate the performance of several remote sensing techniques which show promise in the detection and surveillance of oil slicks. These techniques were utilized in a series of airborne measurements of small controlled oil spills. The general objectives were to gather multispectral signature data for oil, to determine which techniques are useful for surveillance and detection of slicks; and to assess from the remote sensing imagery and ground truth data (sea state, winds, currents, type of oil, etc.) the spreading rate and distribution of oil slicks on the sea. The participants in the experiment and their respective areas of investigation were: (1) Aerojet-General Corporation Microwave Radiometric Investigation - Operation of Discharge Vessel - Surface Observations; (2) Ames Research Center (NASA) - Spectroradiometric Investigations; (3) Naval Research Laboratory - Radar Investigations; and (4) University of Michigan - Multispectral Investigations. The results and findings from these participants are included as four separate papers. (See also W72-04166 thru W72-04169) (Woodard-USGS)
W72-04165

MICROWAVE RADIOMETRIC OBSERVATIONS OF CONTROLLED OIL SPILLS,
Aerojet-General, El Monte, Calif.
A. Edgerton, and P. Hinds.
Available from NTIS, Springfield, Va. 22151 as PB-203 194, $3.00 paper copy, $0.95 in microfiche. In: Remote Sensing of Southern California Oil Pollution Experiment; Coast Guard Office of Research and Development Report p 1-37, July 1971. 26 fig, 2 tab.

Descriptors: *Water pollution, *Oily water, *Pollutant identification, *Remote sensing, *Radio waves, Microwaves, Oceans, Analytical techniques, Aircraft, Water pollution sources, Path of pollutants.
Identifiers: *Oil spills, Microwave radiometry, Oil slicks.

During the fall of 1970, airborne microwave radiometric measurements of controlled oil spills were conducted off the Southern California Coast. Measurements were performed with dual-polarized 3.2- and 8.1- mm sensors utilizing forward antenna viewing angles of 45 degrees. Four sets of oil spills were performed to obtain passive microwave data on oil slicks over a variety of sea-surface conditions. Pollutants used for the tests included No. 2 diesel fuel, 26.1 and 21.6 API gravity crude oils, and 9.7 API gravity fuel oil. For each set of spills, ocean surface observations and airborne measurements were performed for three days, or until the slicks dissipated. Positive identification was made of oil slicks on the open ocean using microwave radiometry. Significant microwave brightness temperature oil slick signatures were noted for a wide range of ocean conditions (sea states 1-4) and oil film thickness (thicknesses less than 1 micron and greater). (See also W72-04165) (Woodard-USGS)
W72-04166

RESULTS OF AIRBORNE MEASUREMENTS TO DETECT OIL SPII LS BY REFLECTED SUNLIGHT,
National Aeronautics and Space Administration, Moffett Field, Calif. Ames Research Center.
J. P. Millard, and J. D. Arvesen.
Available from NTIS, Springfield, Va. 22151 as PB-203 194, $3.00 in paper copy; $0.95 in microfiche. In: Remote Sensing of Southern California Oil Pollution Experiment; Coast Guard Office of Research and Development Report, p 38-62, July 1971. 18 fig, 2 ref.

Descriptors: *Water pollution, *Oily water, *Pollutant identification, *Remote sensing, *Spectroscopy, Analytical techniques, Aircraft, Microwaves, Oceans, Surface waters, Water pollution sources, Path of pollutants.
Identifiers: *Oil spills, *Spectroradiometer, Oil slicks.

Airborne measurements were made over controlled oil-spill test sites to evaluate various radiometric techniques for detecting oil on water. The techniques consisted of absolute radiometry, differential radiometry and polarimetry. All of the techniques were based on measuring the contrast of sunlight reflected or backscattered by oil and water. The instrumentation consisted of a spectroradiometer, which measured spectral radiance over the wavelength range 380 to 950 nm, and a differential radiometer, which measured the difference in radiance between two wavelength bands or two polarization components. The instruments viewed in the nadir direction. The results of these measurements show that (1) maximum contrast between oil and water is in the ultraviolet and red portions of the spectrum; (2) minimum contrast is in the blue-green; (3) differential polarization appears to be a very promising technique; (4) no characteristic absorption bands, which would permit one oil to be distinguished from another, were discovered in the spectral regions measured; (5) sky conditions greatly influence the contrast between oil and water; and (6) highest contrast was achieved under overcast-sky conditions. (See also W72-04165) (Woodard-USGS)
W72-04167

RADAR DETECTION AND MONITORING OF OIL SLICKS,
Naval Research Lab., Washington, D.C.
R. O. Pilon, and C. G. Purves.
Available from NTIS, Springfield, Va. 22151 as PB-203 194 $3.00 in paper copy, $0.95 in microfiche. In: Remote Sensing of Southern California Oil Pollution Experiment; Coast Guard Office of Research and Development Report, p 63-90, July 1971. 17 fig, 2 tab, 2 ref.

Descriptors: *Water pollution, *Oily water, *Pollutant identification, *Path of pollutants, *Radar, Analytical techniques, *Remote sensing, Aircraft, Oceans, Surface waters, Water pollution sources.
Identifiers: *Oil spills, Oil slicks.

The Naval Research Laboratory participated in a joint agency controlled oil slick experiment in the Pacific Ocean, sponsored by the United States Coast Guard in the Fall of 1970. Radar imagery of the oil slicks, on vertical polarization, was obtained at frequencies of 428 MHz, 1228 MHz, 4455 MHz, and 8910 MHz during low sea state conditions. At frequencies of 1228 MHz and higher, the slicks were depicted with sharp boundaries. At 428 MHz, the boundaries were indistinct. Approximately 100 gallons of oil were detected as it was being discharged from the generating ship and similar spills were mapped from the initial thickness to equilibrium thicknesses of 1 micron or less. Thin streamers of oil and wind blown films were also imaged. Area growth rates were obtained for 660 gallon spills of API 26.1 crude oil and API 9.7 fuel oil on a calm sea. (See also W72-04165) (Woodard-USGS)
W72-04168

ANALYSIS OF MULTISPECTRAL DATA FROM THE CALIFORNIA OIL EXPERIMENT OF OCTOBER 1970,
Michigan Univ., Ann Arbor. Willow Run Labs.
R. Horvath, and S. R. Stewart.
Available from NTIS, Springfield, Va. 22151 as PB-203 194, $3.00 in paper copy, $0.95 in microfiche. In: Remote Sensing of Southern California Oil Pollution Experiment; Coast Guard Office of Research and Development Report, p 91-107, July 1971. 7 fig.

Descriptors: *Water pollution, *Oily water, *Pollutant identification, *Remote sensing, *Spectroscopy, Analytical techniques, Aircraft, Oceans, Surface waters, Path of pollutants, Water pollution sources.
Identifiers: *Oil spills, Oil slicks, Multispectral equipment.

The multispectral equipment on The University of Michigan's C-47 aircraft acquired calibrated, optical, remote-sensor data from a controlled oil-spill exercise during October 1970. The spill was located in Pacific coastal waters between Annacapa Island and Santa Barbara Island, California. Four discrete slicks were produced with 330 gallons each of 9.7 API gravity fuel oil, 21.6 API gravity crude oil, 26.1 API gravity crude oil, and No. 2 diesel oil. Multispectral line-scanner data were acquired in 17 spectral bands between the wavelengths of 0.32 and 11.7 millimicrons. Additional aerial photographic data were acquired on panchromatic, normal color, and infrared false-color films. Using index of refraction, scattering and absorption coefficients measured in the laboratory, a mathematical reflectance model for oil on water was used to generate values of radiance from each of the four oils and from water as a function of thickness. The 9.7 API residual fuel exhibited a strange spatial pattern compared to the others after several hours on the water's surface. (See also W72-04165) (Woodard-USGS)
W72-04169

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE NUECES RIVER BASIN, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02K.
W72-04204

A MICROBIOTIC ECOASSAY FOR ENVIRONMENTAL POLLUTANTS,
Massachusetts Univ., Waltham. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 05C.
W72-04208

VANADIUM CONCENTRATIONS IN COLORADO RIVER BASIN WATERS,
Colorado Univ., Boulder. Dept. of Civil Engineering.
K. D. Lindstedt, and P. Kruger.
Journal of the American Water Works Association, Vol 61, No 2, p 85-88, February 1969. 2 fig, 3 tab, 4 ref.

Descriptors: Water quality, *Uranium, *Trace elements, Analytical techniques, Water analysis, Pollutant identification, *Neutron activation analysis, *Mine wastes, New Mexico, Colorado River Basin.
Identifiers: *Vanadium.

Vanadium traces in Colorado River Basin waters, sometimes associated with uranium milling, were measured using neutron activation analysis procedures. The reported physiological significance of trace quantities of vanadium suggested that an examination of the occurence of vanadium in water supplies should be useful. The procedure provided a sensitivity of 0.1 microgram/l for vanadium utilizing a 10-kw research reactor. Vanadium concentrations in samples throughout the Basin varied from 1.2 to 49.2 microgram/l over the 15 month study. Lowest vanadium concentrations were found upstream of any industrial activity. Highest concentrations were found in the vicinity of uranium-vanadium milling operations. (Bean-AWWA)
W72-04233

CHEMICAL CHARACTERIZATION OF A PUBLIC WATER SUPPLY,
Geological Survey, Denver, Colo.
P. R. Barnett, M. W. Skougstad, and K. J. Miller.
Journal of the American Water Works Association, Vol 61, No 2, p 61-67, February 1969. 4 fig, 5 tab, 8 ref.

Descriptors: *Water treatment, Coagulation, Filtration, Aluminum, Boron, Chromium, Copper, Iron, Manganese, Molybdenum, Titanium, Zinc, Water quality, Mineralogy, Chemical properties, Domestic water, *Trace elements, Analytical techniques.
Identifiers: *Minor mineral elements, Barium, Lithium, *Strontium, Rubidium.

A program of periodic sampling and tests for the minor elements was initiated in 1966 by the Denver Board of Water Commissioners, on waters of the Denver system. Spectrochemical and atomic absorption techniques were utilized. Sets of samples were collected in each of the five months, May through September, from both the raw and finished waters of five treatment plants, also from four domestic taps. Of the 25 minor elements looked for, only 13 were found. The thirteen minor elements found were aluminum, barium, boron, chromium, copper, iron, lithium, manganese, molybdenum, rubidium, strontium, titanium and zinc. Chromium was found only in the Kassler Galleries and in concentrations of 3 to 7 microgram/l. Titanium was found in few samples, the maximum was 26 microgram/l in the Kassler Plant; other samples maximum was 9 microgram/l. Molybdenum and strontium concentrations are probably unique among public water supplies, maximums were 260 microgram/l, and 370 microgram/l, respectively. Removal of these by the treatment process is slight. Tables show results of all analyses. (Bean-AWWA)
W72-04235

REACTIONS OF METAL IONS IN DILUTE AQUEOUS SOLUTION: HYDROLYSIS OF ALUMINUM,
Florida Univ., Gainesville, Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05F.
W72-04241

LONG TERM EFFECTS OF PESTICIDES ON STREAM INVERTEBRATES,
Michigan Univ., Ann Arbor. Dept. of Environmental Health; and Michigan Univ., Ann Arbor. Dept. of Industrial Health.
For primary bibliographic entry see Field 05C.
W72-04288

IDENTIFICATION AND REMOVAL OF HERBICIDES AND PESTICIDES,
West Virginia Pulp and Paper Co., New York.
For primary bibliographic entry see Field 05F.
W72-04320

A COLORIMETRIC METHOD FOR THE DETERMINATION OF TRACE COPPER CONCENTRATIONS IN WATER,
Auburn Univ., Ala. Dept. of Chemistry.
J. M. Baker, J. E. Teggins, and J. W. Hoffman.
Water Resources Bulletin, Vol 7, No 6, p 1246-1249, December 1971. 2 fig, 1 tab, 4 ref. OWRR A-023-ALA (1).

Descriptors: *Water analysis, *Copper, *Colorimetry, Ion exchange, Trace elements, Pollutant identification, Chemical analysis, Analytical techniques.

Trace quantities of copper (II) ion are found in natural water as waste products from industrial, mining, and agricultural operations. A simple method was developed in which copper (II) ion is concentrated by a batch ion exchange technique and estimated colorimetrically after formation of the blue triethylenetetramine complex. Using the visible absorption peak of the complex at 600 nm, it is possible to obtain accurate estimations of original copper concentrations in the range 0.5-3 ppm. Using the complex absorption peak at 260 nm in the ultra-violet region of the spectrum increased the sensitivity by a factor of 20. Because of the dependence of the complex formation reaction on solution acidity it is possible to optimize conditions for the detection of copper (II) in the presence of other metal ions. This type of method, which could be extended to the analysis of other metal ions, can be performed by a relatively unskilled technician under field conditions. (Knapp-USGS)
W72-04325

ASSOCIATION AND DISSOCIATION OF A HUMIC ACID FRACTION AS A FUNCTION OF PH,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02K.
W72-04364

PRELIMINARY FINDINGS ON THE DETERGENT AND PHOSPHATE CONTENTS OF WATER OF SOUTHERN NASSAU COUNTY, NEW YORK,
Geological Survey, Mineola, N.Y.
For primary bibliographic entry see Field 05B.
W72-04372

SYSTEMS ANALYSIS OF METHODS FOR MEASURING TRACE DISSOLVED ORGANIC MATTER IN SEAWATER,
Naval Postgraduate School, Monterey, Calif.
G. F. Diehl.
Available from NTIS, Springfield, Va. 22151, as AD-728 665, $3.00 in paper copy. M. Sc. Thesis, Naval Postgraduate School, June 1971. 97 p, 3 fig, 7 tab, 173 ref.

Descriptors: *Chemical analysis, *Organic compounds, *Sea water, *Analytical techniques, Amino acids, Lipids, Carbohydrates, Water chemistry, Salinity, Oceans, Pollutant identification, *Gas chromatography.
Identifiers: Autoanalysis, Total organic carbon.

Three methods are described for measuring dissolved organic compounds in seawater. These methods include quantitative gas chromatographic analysis of all amino acids and qualitative results for histidine, cystine, tryptophan, and arginine; gas chromatographic analysis of lipids including light hydrocarbons, fatty acids, and sterols; and autoanalysis with etrazoleum blue after charcoal adsorption for soluble sugar compounds like glucose, sucrose, and fructose. Synoptic data of these compounds are compared with total organic carbon. (Woodard-USGS)
W72-04382

PCB IN WATER - A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.

Available from NTIS, Springfield, Va. 22151 as PB-206 534, Price $3.00 (Paper copy), .95 in microfiche. Water Resources Scientific Information Center, Report WRSIC 72-201, January 1972. 40 p.

Descriptors: *Chlorinated hydrocarbon pesticides, *Water pollution, *Bibliographies, *Abstracts, Information retrieval, Data storage and retrieval, Publications, Water pollution sources, Documentation, Computers.
Identifiers: *Polychlorinated biphenyls (PCB).

This is a collection of 25 abstracts for selected reports and journal articles published in 1969, 1970, and 1971. The abstracts include full bibliographical citations and a set of descriptors from the Water Resources Thesaurus. The bibliography is a computer printout from the information base comprising only Selected Water Resources Abstracts (SWRA), which had 35,675 abstracts on December 15, 1971 when the search was made. A significant descriptor index is given of representative weighted terms that best describe the information content of the abstracted items. (Lang-USGS)
W72-04439

NATURAL CESIUM IN SEAWATER,
Scripps Institution of Oceanography, La Jolla, Calif.
T. R. Folsom, N. Hansen, and D. E. Robertson.
Available from the National Technical Information Service, Springfield, Va. 22151, as TID-25776, $3.00 in paper copy, $0.95 in microfiche. Preliminary Report of the GEOSECS Committee of Intercalibrations between Scripps Institution and Battelle Northwest. TID-25776, Aug 18, 1970. 9 p.

Descriptors: *Fallout, *Cesium, *Radioactivity techniques, Analytical techniques, Sea water, Sampling, Radioactivity, Instrumentation, On-site data collections, Surveys.

A rapid method for monitoring radioactive cesium in the ocean from fallout has been improved. Before measurement of the radioactivity the cesium is concentrated from seawater by absorption on ferrocyanide granules. The sample size is determined from the amount of natural cesium in the local seawater and the amount in the concentrate. Natural cesium is determined by precipitation with ammonium molybdophosphate, extraction into TBP, and burning in a differential emission photometer. It is found that there is little or no effect on the natural cesium content from long-term storage in polyethylene carboys. (Bopp-ORNL)
W72-04459

PLUTONIUM IN NATURAL WATERS,
Mound Lab., Miamisburg, Ohio.
G. L. Silver.
Available from the National Technical Information Service as MLM-1870, $3.00 in paper copy, $0.95 in microfiche. Report MLM-1870, December 16, 1971. 15 p, 3 tab, 5 ref, append.

Descriptors: *Plutonium, *Measurement, *Water, *Hydrology, *Water chemistry, *Computer programs, Research equipment, Acidity, Chemical properties, Chemical reactions.
Identifiers: Concentration, Natural water, Effect-pH.

A method for estimating the concentrations of soluble trivalent, tetravalent, pentavalent, and hexavalent plutonium in natural waters is illustrated with a small computer program and two examples. The program, which requires the potential and pH of natural waters, may also be used to approximate the proportion of the plutonium which is present as polymer in equilibrium with the soluble plutonium. The first part of the question (fate of plutonium) offers no special problem, but the second part of the question (natural water) remains obscure. (Houser-ORNL)
W72-04471

OPERATIONAL MONITORING OF RADIOACTIVE LIQUID MEDIA BASED ON GAMMA RADIATION,
For primary bibliographic entry see Field 05B.
W72-04475

HEAVY METAL CONCENTRATION IN COASTAL WATERS,
Liverpool Univ. (England). Dept. of Oceanography.
For primary bibliographic entry see Field 05B.
W72-04539

INTERLABORATORY QUALITY CONTROL STUDY NO. 1 - CALCIUM, TOTAL HARDNESS, SODIUM AND POTASSIUM,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
W. J. Traversy, and R. W. Wales.
Canada Department of Energy, Mines and Resources Inland Waters Branch Report Series No 12, 1970. 13 p, 4 fig, 4 tab, 3 ref.

Descriptors: *Chemical analysis, *Water analysis, *Laboratory tests, *Quality control, *Laboratories, Evaluation, Analytical techniques, Calcium, Sodium, Potassium, Hardness (Water), Water chemistry.
Identifiers: *Laboratories (Canada), Interlaboratory quality control.

This is the first of a number of reports on analytical quality control planned by the Water Chemistry Subdivision of the Water Quality Division, Inland Waters Branch, Canada. Because the Division is rapidly expanding with analytical laboratories in Ottawa and Burlington, Ontario; Moncton, New Brunswick; and Calgary, Alberta, it was necessary to establish a quality control program to ensure a high quality of performance in all Divisional laboratories. Each participating laboratory received two ranges of ten identical samples for a total of twenty samples. One analysis was done on each sample for calcium, total hardness (or magnesium), sodium and potassium. Accompanying the samples was a Report Sheet for entering results. Each laboratory was assigned a code number. Analytical methods were not specified although laboratories of the Water Quality Division used only those methods that have been approved by the Division. The results are tabulated and discussed. (Woodard-USGS)
W72-04542

OXYGEN ELECTRODE AND ITS BIOLOGICAL APPLICATIONS,
Wyoming Univ., Laramie. Dept. of Bioengineering.
V. S. Chandra.
M. S. Thesis, May 1971. 26 p, 5 fig, 3 tab, 20 ref. OWRR A-001-WYO (47).

Descriptors: *Water pollution, *Organic loading, *Pollutant identification, *Electrodes, Analytical techniques, Aerobic bacteria, Oxygen demand.
Identifiers: *Clark electrode.

Experiments were conducted to establish whether the prevalence of catalase activity in micro-organisms can be used as a reliable indicator of organic pollution in water samples. The enzyme catalase is present universally among plants and animals, most algae and fungi and in all aerobic bacteria and most facultative anaerobic bacteria. Further the enzyme does not require any co-factors nor activators and has no pH optimum between pH 3 and 9 in which region catalase exhibits maximum activity. The enzyme kinetics are unaffected by tempera-

ture changes between 4 degrees and 25 degrees C. The Clark electrode was found to be a very convenient means of measuring catalase activity, and oxygen uptake of polluted water samples. Control experiments were made using glucose-grown pure cultures of E. coli and Micrococcus lysodeikticus. The catalase activity of artificially polluted water samples was compared with the control runs. (Woodard-USGS)
W72-04543

SIMULTANEOUS QUANTITATION OF SALMONELLA SPECIES AND PSEUDOMONAS AERUGINOSA. I. POLLUTED WATERS,
National Environmental Research Center. Cincinnati, Ohio.
B. A. Kenner.
September 1, 1971. 1 of 3 papers, 36 p. Paper I, 6 tab, 33 ref, 1 append.

Descriptors: *Water pollution, *Pathogenic bacteria, *Salmonella, *Pseudomonas, *Methodology, Monitoring, Effluents, Streams, Runoff, Sludge, Filters, Municipal wastes, Industrial waste, E. coli, Analytical techniques, Sewage, Waste water (Pollution), *Enteric bacteria, Anerobic digestion, Activated sludge.
Identifiers: Primary sludge, Primary effluent, Secondary effluent, Package plant effluent, Trickling filter effluent.

A practical sensitive quantitative method for the isolation and enumeration of Salmonellae and pyocyanogenic Ps. aeruginosa from wastewaters, treatment effluents, streams, stormwater runoff, and sludges, in all seasons of the year is described. The multiple tube test enrichment broth is enhanced by the addition of a killed culture of S. paratyphi A. Incubation of primary enrichment at 40 C is critical. Inoculum for secondary culture is taken from the surface of primary enrichment broth series as salmonella have a superior swimming ability. Secondary culture on non-toxic XLD agar plates allows the isolation of distinctive colonies of Salmonella sp. and Ps. aeruginosa, and the test as employed practically eradicates the time-wasting picking of false positive colonies due to related Enterobacteriaceae. Provisions are made to obviate MPN 'skips.' The use of glass fiber ultra filters allows the testing of low turbidity to crystal-clear waters in a range from 1-liter to 10-gallon samples. The methods described are useful testing treatment plant effluents, streams, well waters, and non-chlorinated drinking waters. An appendix and six tables describe, in detail, media employed, schemata for five multiple tube methods, quantitative results obtained compared with published qualitative results, and proof for claims made for critical temperature, and the use of glass fiber ultra filters. (EPA abstract)
W72-04559

SIMULTANEOUS QUANTITATION OF SALMONELLA SPECIES AND PSEUDOMONAS AERUGINOSA. III. ANALYSIS OF WASTE TREATMENT SLUDGES FOR SALMONELLA SPECIES AS A SURVEILLANCE TOOL,
National Environmental Research Center, Cincinnati, Ohio.
B. A. Kenner.
September 1, 1971. Third of three papers, 36 p. Paper III, 1 tab, 5 ref.

Descriptors: *Public health, *Epidemiology, *Municipal wastes, *Sludge, *Salmonella, Pathogenic bacteria, Analysis, Waste water treatment, Sewage treatment, Activated sludge, Anaerobic digestion.

It is suggested that a more complete and useful surveillance of salmonellosis for large urban areas can be attained by analysis monthly of municipal primary and secondary waste treatment plant sludges. Results obtained can indicate current high carrier rates of certain Salmonella serotypes or suggest the presence of pathogens in local food or feed products that may need inspection to avert spread. (EPA abstract)
W72-04561

IMPROVEMENTS IN THE COLLECTION OF HYDROGEN SULFIDE IN CADMIUM HYDROXIDE SUSPENSION,
Washington State Univ., Pullman. Coll. of Engineering.
W. L. Bamesberger, and D. F. Adams.
Environmental Science and Technology, Vol 3, p 258-261, 1969. 2 fig, 3 tab, 11 ref. Grant No. AP-00215 Division of Air Pollution, U.S. Public Health Service.

Descriptors: *Hydrogen sulfide, *Oxidation, Chemical reactions, Analytical techniques, Ions, Laboratory tests, Efficiency performance, Colloid suspension, Hydrogen ion concentration.
Identifiers: *Cadmium hydroxide, Absorption solution, Aspirator, Alkaline solutions, Jacobs method.

The technique of collecting hydrogen sulfide at ambient air concentrations in cadmium hydroxide suspension, in use for more than 10 years, is reported to prevent loss from sulfide oxidation. A comparison of this procedure with bromine microcoulometric titration and with calculations of the anticipated hydrogen sulfide concentrations produced in a laboratory gas dilution system revealed an unpredictable and nonreproducible loss of hydrogen sulfide as high as 80% during collection of a 2-hour impinger sample containing cadmium hydroxide suspension. Evidence is given of the photodecomposition of cadmium sulfide in the impinger and techniques are described to reduce loss of sulfide during sampling and storage. The suggested modification provides reproducible hydrogen sulfide recoveries. Reliable quantitative results were obtained. (Bundy-Iowa State)
W72-04630

EFFECT OF EARLY DAY MINING OPERATIONS ON PRESENT DAY WATER QUALITY,
Idaho Univ., Moscow. Coll. of Mines.
For primary bibliographic entry see Field 05C.
W72-04655

PROPOSED BASE-LINE SAMPLING PROGRAM,
E. D. Goldberg, G. Arnason, J. L. Reid, M. G. Gross, and F. Lowman.
In: Chlorinated Hydrocarbons in the Marine Environment, National Academy of Science Publication, Washington, D C, Appendix A, p 23-36, 1971. 3 fig, 2 tab, 5 ref.

Descriptors: *Network design, *Water pollution sources, *Water quality control, *Chlorinated hydrocarbon pesticides, *Surface waters, Streams, Reservoirs, Sampling, Oceans, Sediments, Data collections, Hydrologic data, Programs, Project planning, Ecosystems.
Identifiers: *Marine environment.

A one-year study is proposed to gather approximately 1,000 samples from wind systems, ocean current systems, organisms, rivers, glaciers, rain, and sediments for a chlorinated hydrocarbon baseline program for the marine environment. The collection of adequate samples of marine organisms is important in areas of high primary productivity and major fisheries since several of these areas are near sites of dense human population and pollution production, support relatively large marine biomasses that may serve as reservoirs with slow turnover rates for pollutants, and provide food pathways leading to man through his utilization of marine fishery products. Samples of water and sediment should be composited in space and time. This procedure permits an estimate of concentrations for quasi-steady-state releases and should work well for dissolved constituents. For rivers, two sampling periods are suggested--high-flow and low-flow stages--each of 6 months' duration. (See also W71-11472) (Woodard-USGS)
W72-04665

IDENTIFICATION OF GLOBALLY DISTRIBUTED WASTES IN THE MARINE ENVIRONMENT,
E. D. Goldberg, and M. G. Gross.
In: Chlorinated Hydrocarbons in the Marine Environment, National Academy of Science Publication, Washington, D C, Appendix B, p 37-42, 1971. 3 tab, 9 ref.

Descriptors: *Water pollution sources, *Pollutant identification, *Pollutants, *Chlorinated hydrocarbon pesticides, *Oceans, Atmosphere, Surface waters, Sediment transport, Currents (Water), Water circulation, Wastes, Industrial wastes, Toxins.
Identifiers: *Marine environment.

A set of base-line measurements are proposed to identify distributions and concentrations of man-introduced materials in the atmosphere and ocean. Such a program can define present or potential threats to the continued survival and well-being of marine ecosystems. Already, mercury, halogenated hydrocarbons, and oil have been widely recognized. Other materials of comparable significance should be identified. Attention is focused primarily on atmospherically transported materials for several reasons: river-carried solids are extremely diverse in type and are deposited primarily near the river mouth; backgraund concentrations of natural riverborne particles are large and variable and can therefore mask man's contributions; and airborne materials are widely dispersed over oceanic areas within days or weeks after injection into the atmosphere. Materials that may pose problems to the marine environment are grouped into three categories: particles from the combustion of fossil fuels and from industrial activities, elements introduced to the atmosphere in amounts comparable to those brought tot the world's rivers by natural processes, and synthetic organic chemicals. (See also W71-11472) (Woodard-USGS)
W72-04666

5B. Sources of Pollution

PRESENT AND FUTURE SALINITY OF THE COLORADO RIVER,
Colorado River Board of California, Los Angeles.
For primary bibliographic entry see Field 03C.
W72-04106

ANIMAL WASTE UTILIZATION FOR POLLUTION ABATEMENT,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
O. E. Cross, A. P. Mazurak, and L. Chesnin.
Preprint, presented at American Society of Agricultural Engineers 1971 Winter Meeting, Chicago, Illinois, December 7-10, 1971, Paper no 71-906. 23 p, 8 fig, 9 ref. OWRR B-003-NEB (3).

Descriptors: *Farm wastes, *Cattle, Rates of application, *Furrow irrigation, Surface runoff, Groundwater movement, Nitrogen, Phosphorus, Potassium, Electrical conductivity, Crop response, Nutrients, Percolation, Sudangrass, *Path of pollutants, Pollution abatement.
Identifiers: *Feedlot wastes, Runoff losses, Surface runoff pollution.

Beef feedlot manure was applied to plots at levels of 0, 40, 120 and 260 tons dry matter per acre. The manure was disk plowed into the soil at 4, 8, and 12 inch depths. A sorghum-sudan forage was seeded at three plant populations, a 'low,' 'medium,' and 'high' density and was furrow irrigated according to standard irrigation techniques. Data was documented as to: pollutional potential of surface runoff water, pollutional contribution to underground water supply, physical and chemical changes in the soil, irrigation techniques, and crop response. The conclusions are the result of one year's test. Nitrogen and sodium displacement did not pollute the surface runoff water. The transport of potassium restricted the runoff to irrigation

uses only. However, the underground water was not affected by the plots and retained its potable quality. Additional information is required to establish irrigation techniques; however, to date conclusions are: (1) the initial intake rate of water into the soil increases as higher manure loadings are applied, (2) the basic intake rate is higher on areas plowed 8 inches deep as compared to areas plowed 4 or 12 inches deep, and (3) the basic intake rate increases with time elapse after application. The application of manure increased the crop yield with the exception of the 260 ton application. (Bundy-Iowa State)
W72-04118

FERTILIZER NITROGEN: CONTRIBUTION TO NITRATE IN SURFACE WATER IN A CORN BELT WATERSHED,
Washington Univ., St. Louis, Mo. Center for the Biology of Natural Systems.
D. H. Kohl, G. B. Shearer, and B. Commoner.
Science, Vol 174, No 4016, p 1331-1334, December 24, 1971. 2 fig, 12 ref.

Descriptors: *Fertilizers, *Nitrogen, *Agricultural watersheds, *Path of pollutants, Nitrates, Surface waters, Illinois, Drainage, Tile drains, Corn belt, Farm wastes, *Spectrophotometry, Nutrients, Lakes, Rivers, Analytical techniques, Radioactivity techniques, Water pollution sources.
Identifiers: Sangamon River (Ill), Lake Decatur (Ill), *Mass spectrometry, Sample preparation, Nitrogen-15.

Nitrate concentration and relative nitrogen-15 enrichment were measured in surface water samples from Lake Decatur and the Sangamon River in the Illinois corn belt watershed region and in the effluent from subterranean tiles that drain the cropped land in the region. A mass-spectrometer with dual-sample collection capability allowed determination of nitrogen-15 to plus or minus 1 unit. Samples were prepared by reducing the nitrate to NH4 (+), after distilling off any NH4 (+) initially present. It was necessary to take extreme care not to lose any of the sample during preparation. From the measurements, it was estimated that at the time of peak nitrate concentration in the spring of 1970, at least 55 to 60 percent of the nitrogen found as nitrate in surface waters originated from fertilizer nitrogen. (Mortland-Battelle)
W72-04133

THE PRESENCE OF PETROLEUM RESIDUES OFF THE EAST COAST OF NOVA SCOTIA, IN THE GULF OF ST. LAWRENCE, AND THE ST. LAWRENCE RIVER,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
For primary bibliographic entry see Field 05A.
W72-04139

DIRECT FIELD DETERMINATION OF THE NATURAL REAERATION COEFFICIENT BY FREQUENCY RESPONSE ANALYSIS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Chemical and Biochemical Engineering.
For primary bibliographic entry see Field 05G.
W72-04159

REMOTE SENSING OF SOUTHERN CALIFORNIA OIL POLLUTION EXPERIMENT.
Coast Guard, Washington, D.C. Pollution Control Branch.
For primary bibliographic entry see Field 05A.
W72-04165

MICROWAVE RADIOMETRIC OBSERVATIONS OF CONTROLLED OIL SPILLS,
Aerojet-General, El Monte, Calif.
For primary bibliographic entry see Field 05A.
W72-04166

RADAR DETECTION AND MONITORING OF OIL SLICKS,
Naval Research Lab., Washington, D.C.
For primary bibliographic entry see Field 05A.
W72-04168

EVALUATION OF THE FIELD PERCOLATION TEST AND AN ALTERNATIVE PROCEDURE TO TEST SOIL POTENTIAL FOR DISPOSAL OF SEPTIC TANK EFFLUENT,
Wisconsin Univ., Madison. Geological and Natural History Survey.
J. Bouma.
Soil Science Society of America Proceedings, Vol 35, No 6, p 871-875, November-December 1971. 3 fig, 2 tab, 23 ref.

Descriptors: *Infiltration, *Soil disposal fields, *Percolation, *Hydraulic conductivity, *On-site testing, Domestic wastes, Path of pollutants, Soil water movement, Septic tanks, Wisconsin.
Identifiers: Field percolation tests.

In four field tests in well drained pedons in Wisconsin, infiltration rates of the variable-head percolation test procedure, required by law in many states to test soil suitability for disposal of septic tank effluent, were much higher than hydraulic conductivity (K) for saturated soil, and more variable. Soil moisture tensions were recorded around operating, partly filled, seepage beds in different soils indicating the occurrence of low flow rates through unsaturated soil, due to crusting at the soil interface of the seepage beds. Measurement of K values in situ, as a function of soil moisture tension, is proposed as a field test to determine soil potential for effluent disposal. (Knapp-USGS)
W72-04186

ADSORPTION OF DDT ON SOLID PARTICLES,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
D. F. Champion, and S. R. Olsen.
Soil Science Society of America Proceedings, Vol 35, No 6, p 887-891, November-December 1971. 10 fig, 1 tab, 8 ref.

Descriptors: *Adsorption, *Pesticide residues, *Ion exchange, *Soils, *Clays, Organic matter, Colloids, Clay minerals, DDT, Dieldrin.

DDT adsorption from water by ion exchange resins, aluminum oxides, ion exchange celluloses, and soils was determined by measuring carbon-14 labeled DDT remaining in solution. The positively charged adsorbents adsorbed more DDT from solution than the negatively charged adsorbents. In addition, the association of DDT with organic matter and colloidal clay in the aqueous phase resulting from sedimented soils increased DDT in solution. The chlorine atoms on the ethyl group of the DDT molecule possess a slight negative charge which was mainly responsible for the adsorption of DDT. (Knapp-USGS)
W72-04192

RETENTION OF THREE INSECTICIDES ON DIFFERENT SIZE SOIL PARTICLES SUSPENDED IN WATER,
Agricultural Research Service, Orono, Maine. Dept. of Plant and Soil Science.
E. M. Richardson, and E. Epstein.
Soil Science Society of America Proceedings, Vol 35, No 6, p884-887, November-December 1971. 7 tab, 12 ref.

Descriptors: *Adsorption, *Pesticide residues, *Soils, *Clays, Clay minerals, Ion exchange, Sands, Silts, Particle size, Organic matter.

The retentions of DDT, endosulfan and methoxychlor on different sized soil particles, were studied using samples of Marshall silt loam from Iowa and Caribou silt loam from Maine. A portion of each soil was treated with H2O2 to study the effect of organic matter. Retention of DDT and methoxychlor was highest in the clay fraction of both treated and untreated soils. In the untreated soils the greatest retention of the three insecticides was on the colloidal and 0.08-0.5 micron fraction. Removing the organic matter from both soils reduced the retention on both clay fractions. The two soils reacted differently to the H2O2 treatment although the three insecticides followed very similar trends within a soil. Although organic matter contributes to the retention of the insecticides studied, other soil properties also are responsible for adsorption. (Knapp-USGS)
W72-04193

REGIONAL ENVIRONMENTAL POLLUTION OPERATIONS PLAN.
Tulsa City-County Health Dept., Okla. Environmental Health Div.

Available from NTIS, Springfield, Va. 22151 as PB-202 839, $3.00 paper copy; $0.95 cents microfiche. Indian Council of Governments Report, June 1971. 70 p, 5 fig, 9 tab, 11 ref.

Descriptors: *Water pollution sources, *Regional analysis, *Pollutants, *Regions, *Surveys, *Oklahoma, Reviews, Air pollution, Indian reservations, Municipal wastes, Domestic wastes, Industrial wastes, Environmental effects, Solid wastes, Pollution abatement.
Identifiers: *Indian Nations Council of Governments, *Tulsa (Okla).

Under a contract with the Indian Nations Council of Governments (INCOG) the Tulsa City-County Health Department carried out a general investigation of the sources and extent of environmental pollution resulting from various activities in the region. The areas of environmental contamination analyzed were air, water, solid waste, noise, and visual pollution. A short summary of the Federal and State role in environmental pollution is included. The sources of water pollution in the region originate mainly from inadequately treated municipal effluents; raw sewage as a direct result of bypassing mechanical sewage treatment plants due to excessive precipitation or lack of fail-safe and back-up equipment; inadequately treated or untreated industrial wastes; urban storm water pollution from the various communities; and salt water pollution from oil wells. The drainage basins where the problem is acute and where joint treatment facilities are needed are Haikey Creek, Spunky Creek, Sand Springs area, and Fry Creek. Recommendations for future detailed investigation and projects are made. General work elements to be accomplished for each investigation and project are included. (Woodard-USGS)
W72-04206

VANADIUM CONCENTRATIONS IN COLORADO RIVER BASIN WATERS,
Colorado Univ., Boulder. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05A.
W72-04233

WORKSHOP-CONFERENCE ON RECLAMATION OF MAINE'S DYING LAKES.
Maine Univ., Bangor.
For primary bibliographic entry see Field 05C.
W72-04279

DISTRIBUTIONAL ECOLOGY AND BEHAVIORAL THERMOREGULATION OF FISHES IN RELATION TO HEATED EFFLUENT FROM A STEAM-ELECTRIC POWER PLANT (LAKE MONONA, WISCONSIN),
Wisconsin Univ., Madison. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W72-04295

SPRAY IRRIGATION SYSTEM FOR TREATMENT OF CANNERY WASTES,
Campbell Soup Co., Camden, N.J.

For primary bibliographic entry see Field 05D.
W72-04315

BASIC DATA REPORT ON THE TURBULENT SPREAD OF HEAT AND MATTER,
Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 08B.
W72-04333

WIND-DRIVEN CURRENTS IN A LARGE LAKE OR SEA,
Northwestern Univ., Evanston, Ill. Dept. of Engineering Sciences; and Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02H.
W72-04335

THE EFFECT OF UNLINED TREATED SEWAGE STORAGE PONDS ON WATER QUALITY IN THE OGALLALA FORMATION,
Texas Tech. Univ., Lubbock. Water Resources Center.
D. M. Wells.
Available from the National Technical Information Service as PB-206 517, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report December, 1971. 36 p, 9 fig, 1 tab, 19 ref. OWRR B-021-TEX (1).

Descriptors: Cities, *Nitrates, Municipal wastes, *Sewage lagoons, Groundwater movement, Phosphorus, Chlorides, Dissolved solids, Irrigation water, Path of pollutants, Percolation, Water pollution sources, Texas, Storage, *Waste storage, *Nitrogen compounds.
Identifiers: *Ogallala aquifer, *Lubbock (Tex.).

The purpose was to establish the rate at which pollutants move from an unlined treated sewage storage pond into the underground formation and the rate at which such pollutants move laterally through the formation. Of secondary importance was the rate at which water infiltrates into the formation from the storage pond. Although municipal effluent contains many compounds that are potential pollutants of groundwater, this research was focused on nitrate as a pollutant because of its known high concentration under and near the City of Lubbock disposal operation, because of its importance to health with regard to animals, human beings, and plants, and because of its initial relatively low concentration in groundwater in the area. The research did not accomplish the stated objectives since the complexity of the problem was underestimated. If such a project is to be successful: (1) All water utilized for any purpose on the project must be carefully metered including effluent delivered, effluent used for irrigation, effluent wasted, groundwater pumped, and surface runoff entering or leaving. (2) A dense network of observation wells which can be sampled and monitored for water surface elevations is essential. Production wells are unsatisfactory. (3) Groundwater samples analyzed must be representative of the entire saturated thickness of the aquifer. (4) More research is needed to predict with a higher degree of certainty the relationships between the concentrations of nitrogenous compounds in stored surface waters, the depth and composition of underlying sludge blankets, and the resultant quality of percolating groundwater. (Runkles-Texas A and M)
W72-04349

DISPERSION OF THERMAL EFFLUENTS,
Washington State Univ., Pullman. Coll. of Engineering.
Claud C. Lomax.
Available from the National Technical Information Service as PB-206 526, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report 1971. 70 p, 25 fig, 103 ref, append. OWRR A-036-WASH (1).

Descriptors: *Thermal pollution, *Jets, *Dispersion, *Turbulence, Water pollution sources, Path of pollutants, Water pollution control, Effluents, Temperature, Flow, Fluid mechanics.
Identifiers: *Thermal plumes, *Ambient fluid.

On the basis of a literature review and experimental results, some means of controlling a thermal plume are suggested. Rate of rise and lateral spread of a heated jet are increased as the difference in temperature between the jet and ambient fluid increases. Solid boundaries, high shear zones, and local turbulence all increase dispersion of the jet. Deeper submergence and lower jet velocities reduce the lateral spread. It should be recognized that most of the surplus heat remains in the ambient fluid. The distribution of this heat can be controlled to some extent in the region just downstream of the efflux if specifications are available for the desired distribution. For example, surface spread of a hot jet can be reduced by mixing with cooler ambient fluid before the jet surfaces. This increases the depth and width (below the surface) over which the heat is distributed.
W72-04352

PRELIMINARY FINDINGS ON THE DETERGENT AND PHOSPHATE CONTENTS OF WATER OF SOUTHERN NASSAU COUNTY, NEW YORK,
Geological Survey, Mineola, N.Y.
N. M. Perlmutter, and E. Koch.
Available from GPO, Washington, DC 20402, Price $2.50. Geological Survey Research 1971, Chapter D, Professional Paper 750-D, p D171-D177, 1971. 5 fig, 8 ref.

Descriptors: *Water pollution sources, *Septic tanks, *Detergents, *Surface waters, *Groundwater, New York, Cities, Urbanization, Biodegradation, Sampling, Phosphates, Path of pollutants, Water quality, Water analysis, Pollutant identification.
Identifiers: *Long Island (NY), *Detergents (MBAS), *Urban hydrology.

The distribution of MBAS (methylene blue active substance) and phosphate in the water of Nassau County, Long Island, N.Y. were studied from 1966 to 1970. The MBAS, a detergent constituent, has entered the water in the sewage effluent from several hundred thousand cesspools and septic tanks. The phosphate has a mixed origin. Although some samples of shallow groundwater had MBAS contents of as much as 2 milligrams per liter, this constituent is not a significant problem in the Magothy aquifer, the major source of public water supply. MBAS content of streams in some areas averaged as much as 0.48 mg/liter. A slight downward trend in MBAS content since 1966 may be due to natural dilution after a regional drought and introduction of a more diodegradable detergent in 1966. The phosphate content of shallow groundwater averaged 0.01 mg/liter. The low concentrations of MBAS and phosphate in most of the water are not known to be toxic. (Knapp-USGS)
W72-04372

RELATIONSHIP BETWEEN GROUND-WATER LEVELS AND QUALITY IN SHALLOW OBSERVATIONS WELLS, MUDDY CREEK BASIN, SOUTHEASTERN YORK COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, Pa.
For primary bibliographic entry see Field 02K.
W72-04373

MATHEMATICAL MODEL TO COMPUTE REAERATION COEFFICIENTS FOR THE CONNECTICUT RIVER,
Geological Survey, Hartford, Conn.
L. A. Weiss.
Available from GPO, Washington, DC 20402, Price $2.50. Geological Survey Research 1971, Chapter D, Professional Paper 750-D, p D165-D170, 1971. 6 fig, 1 tab, 6 ref.

Descriptors: *Reaeration, *Rivers, *Thermal pollution, *Connecticut, Mathematical models, Dispersion, Water temperature, Estuaries.
Identifiers: Connecticut River.

Data from a dissolved-oxygen survey on August 27, 1968, at the Connecticut Yankee Atomic Power Co. plant at Haddam Neck, Conn., were used as input to a one-dimensional mathematical model to compute reaeration coefficients for short time intervals in the estuary. The reaeration coefficients ranged from 0.16 to 1.31 per day at 20 deg C and were directly related to stream velocity. Because the fluctuations in depth were small compared to the total depth, they were not evaluated separately. New oxygen produced from before dawn to after sunset seemed to be affected spatially and temporally by power plant effluent. (Knapp-USGS)
W72-04374

A PRELIMINARY NOTE ON THE RELATIONSHIPS BETWEEN FORAMINIFERS AND POLLUTION IN TWO PUERTO RICAN BAYS,
Puerto Rico Univ. Mayaguez. Dept. of Geology.
G. A. Seiglie.
Caribbean Journal of Science, Vol 11, No 1-2, p 93-98, March-June 1971. 3 fig, 9 ref.

Descriptors: *Water pollution sources, *Bays, *Water pollution effects, *Nuclear wastes, *Puerto Rico, Aquatic animals, Thermal pollution, Ecosystems, Water temperature, Salinity, Sediments, Ecology.
Identifiers: *Foraminifers, Jobos Bay (P.R.), Mayaguez Bry (P.R.).

The study of the foraminifers of Jobos Bay and Mayaguez Bay is part of a general ecological study by the Puerto Rico Nuclear Center. The temperatures in Mayaguez Bay range from 24.9 deg C to 29.6 deg C and salinities from 33.3 ppt. to 36.0 ppt. In Jobos Bay, temperatures range from about 26 deg C to 29.5 deg C and salinities from about 36 ppt. to 38 ppt. in winter. Jobos Bay is shallower than Mayaguez Bay; its maximum depth is 9 meters, and consequently the foraminiferal species affected by pollution are different than in Mayaguez Bay. The area most affected by pollution is the north-western part close to the piers of Central Aguirre and to the sewage disposal of this sugar mill. The highest population in this part of the bay 435 foraminifers per 10 sq cm. is dominated by Ammonia tepida variants with all the individuals megalospheric and most of them abnormal. The large population of Florilus grateloupii in the Bay of Cayo Puerca indicated the relation of foraminifer to the high content of organic carbon in sediments and to anaerobic conditions. (Woodard-USGS)
W72-04386

POLLUTION EVALUATION SURVEY OF THE INTERSTATE WATERS OF THE RED RIVER OF THE NORTH, NORTH DAKOTA-MINNESOTA,
Federal Water Quality Administration, Kansas City, Mo.
B. Hegg.
Available from NTIS, Springfield, Va. 22151 as PB-202 556, $3.00 paper copy, $0.95 in microfiche. Federal Water Quality Administration, Missouri Basin Region Report, June 1970. 115 p, 17 fig, 27 tab.

Descriptors: *Water pollution sources, *Water quality, *Rivers, *North Dakota, *Minnesota, Chemical analysis, Dissolved oxygen, Nitrogen, Ammonia, Coliforms, Industrial wastes, Municipal wastes, Water pollution control, Standards, Governments.
Identifiers: *Red River of the North.

A pollution evaluation survey was conducted on the Red River of the North (Fargo, N. Dak. to Oslo, Minn.) from September 1969 to April 1970. The combined waste discharges from the Fargo-

Moorhead Area had an adverse effect on the water quality. Violations of North Dakota's and Minnesota's Water Quality Standards included the dissolved oxygen criteria, the ammonia nitrogen and ammonia criteria, the bacterial criteria and violation of State effluent requirements. The critical period for maintaining 5 mg/l of dissolved oxygen in the Red River of the North was during winter months under conditions of ice cover. Total coliform densities at Oslo, Minnesota ranged from 7,900 MPN per 100 ml to 24,000 MPN per 100 ml exceeding both States' criteria of 5,000 MPN per 100 ml. (Woodward-USGS)
W72-04400

DETERGENTS IN WATER - A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.

Available from NTIS, Springfield, Va. 22151 - as PB-206 527 Price $6.00 (paper copy); $0.95 in microfiche. Water Resources Scientific Information Center Report WRSIC 71-214, December 1971. 460 p.

Descriptors: *Detergents, *Water pollution, *Bibliographies, *Abstracts, Data storage and retrieval, Digital computers, Water pollution sources, Documentation, Chemical wastes, Alkylbenzene sulfonates, Environmental effects, Publications.
Identifiers: *Notice of Research Projects (NRP).

A compilation of 282 abstracts is presented for selected reports, journal articles, and various documents published mostly since 1966 on the subject. The abstracts include full bibliographical citations and a set of descriptors from the Water Resources Thesaurus. The bibliography is produced from two computerized information bases that complement each other in summarizing completed and ongoing research as documented by the Water Resources Scientific Information Center: (1) Selected Water Resources Abstracts (SWRA) and (2) Notices of Research Projects (NRP). Descriptions are given for 44 research projects in progress as registered with the Smithsonian Science Information Exchange. At the time of computer search for this bibliography, the SWRA information base contained almost 35,000 items. A significant descriptor index is given of representative weighted terms that best describe the information content of the abstracted items. A comprehensive index is given that represents all descriptors and identifiers used to index the different papers in the bibliography. Items in the bibliography are arranged in ascending WRSIC Accession No. sequence. (Land-USGS)
W72-04438

PCB IN WATER - A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.
For primary bibliographic entry see Field 05A.
W72-04439

MERCURY IN WATER-A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.

Available from NTIS, Springfield, Va. 22151 as PB-206 535, Price $3.00 (Paper copy), .95 in microfiche. Water Resources Scientific Information Center, WRSIC 72-214, January 1972. 294 p.

Descriptors: *Heavy metals, *Water pollution sources, *Water chemistry, *Bibliographies, *Abstracts, Data storage and retrieval, Computers, Documentation, Publications, Chemical wastes, Environmental effects, Public health, Poisons, Geochemistry, Analytical techniques.
Identifiers: *Mercury, Notice of Research Projects (NRP).

This is a compilation of 195 abstracts for selected reports, journal articles, and various documents published mostly since 1967 on mercury in water. The abstracts include full bibliographical citations and a set of descriptors from the Water Resources Thesaurus. This bibliography supercedes an earlier edition on the subject (WRSIC 71-207), and is produced from two complementary computerized information bases. One base contains Selected Water Resources Abstracts (SWRA) and the other contains Notice of Research Projects (NRP). The SWRA portion represents published research in water resources, as abstracted and indexed in the SWRA journal. At time of the computer search for this bibliography the data base had 35,675 abstracts covering SWRA through December 15, 1971. Notices and descriptions are given for 10 research projects underway on mercury in water; these are registered with Smithsonian Science Information Exchange. A significant descriptor index is given of weighted terms that best describe the information content of the abstracted items. A comprehensive index lists all descriptors and identifiers used to index each paper represented by an abstract. The bibliography is arranged in ascending WRSIC Accession No. order. (Lang-USGS)
W72-04440

ANTIMONY-124 IN THE LOWER COLUMBIA RIVER,
Oregon State Univ., Covallis. Dept. of Oceanography.
Stephen V. W. Pope.
M. S. Thesis, June 1970. 57 p, 6 fig, 6 tab, 25 ref, 2 append.

Descriptors: *Path of pollutants, *Columbia River, River flow, Radioactivity techniques, Tracking techniques, Zinc radioisotopes, On-site investigations, Flocculation, Adsorption, Sediment transport.
Identifiers: *Antimony radioisotopes, Chromium radioisotopes, Scandium radioisotopes.

Average transport rates (curies/day) in early spring 1969 past Vancouver were: Sb-124 (1.5), Cr-51 (200), Sc-46 (11), and Zn-65 (10). Equilibrium activities (curies), obtained by setting the rate of discharge equal to the rate of decay, were: Sb-124 (140), Cr-51 (8000), Sc-46 (1300), and Zn-65 (3500). A large standard deviation in the Cr-51/Sb-124 ratio prevented its use to estimate the flow rate of the Columbia River. Most Cr-51 and Sb-124 were in the soluble phase, but most Zn-65 and Sc-46 were in the particulate phase. (Bopp-ORNL)
W72-04446

NITROGEN-15 IN SOIL-PLANT STUDIES.
International Atomic Energy Agency, Vienna (Austria).

Available from UNIPUB, Inc., P.O. Box 433, New York, N.Y. 10016, Price $7.00. Proceedings of a Research Co-ordination Meeting Organized by the Joint FAO/IAEA Division of Atmomic Energy in Food and Agriculture, Sofia, 1-5 December 1969. 225 p.

Descriptors: *Water pollution sources, *Nitrates, *Agricultural chemicals, Path of pollutants, Soil environment, Pollution abatement, Nitrogen fixing bacteria, Rhizosphere, Rice, Nitrogen cycle, Stable isotopes, Tracers, Soil-water-plant relationships, Spectroscopy, Analytical techniques, Plant physiology, Proteins, Reviews.

Progress is summarized in 18 papers on (a) the fate of fertilizer N in both upland and paddy soils, (b) in-situ N-balance studies, (c) factors affecting N adsorption by roots, (d) metabolic pathways of N-assimilation in plant tissue, (e) movement of N solutes within the plant, and (f) optical spectroscopy techniques for N-15 assay. Recommendations are made for conducting mission-oriented, international field experiments which should provide data on problems related to the effects of environmental soil and management factors on the conversion of fertilizer N into grain protein. The role of microorganisms in assimilation of N by plants was studied using radiation-sterilization techniques. An analogue computer was used for simulation of ion uptake by roots. Efficient fertilizer use is essential in preventing build-up of nitrogen in groundwater. (See also W72-04449 and W72-04450) (Bopp-ORNL)
W72-04448

BIOLOGICAL NITROGEN FIXATION AND ITS ECONOMIC SIGNIFICANCE,
Instituut voor Toepassing van Atoomenergie in de Landbouw, Wageningen (Netherlands).
J. H. Becking.
In: Proceedings of a Research Co-ordination Meeting (Nitrogen-15 in Soil-Plant Studies), organized by the Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture, Sofia, 1-5 December, 1969. p 189-222, 10 fig, 11 tab, 153 ref.

Descriptors: *Nitrogen cycle, *Soil-water-plant relationships, *Nitrogen fixing bacteria, *Azotobacter, Rice, Aquatic soils, Cyanophyta, Fertilization, Water pollution sources, Stable isotopes, Reviews, Pollution abatement, Path of pollutants, Tracers, Analytical techniques, On-site investigations.

This review emphasizes the importance of N-fixing microorganisms for rice culture, especially since the chemical production of fertilizers will not be able to catch up with increasing demands in these regions. It has been shown that blue-green algae are mainly responsible for the remarkable ability of submerged rice soils to supply N to successive rice crops. In-situ experiments under natural conditions with the total ecosystem of microorganisms are needed to give the contribution of free-living, N-fixing agents to the N economy. Such experiments can be performed with N-15 or with the sensitive test in which the reduction of N is inhibited by addition of acetylene. High quality edible protein can be produced by (Azotobacter) fermentation of waste molasses in sugar-cane producing regions. (See also W72-04448) (Bopp-ORNL)
W72-04449

INFLUENCE OF MICROORGANISMS ON ASSIMILATION OF NITROGEN BY PLANTS FROM SOIL AND FERTILIZER SOURCES,
Agricultural Research Council, Wantage (England). Letcombe Lab.
D. A. Barber.
In: Proceedings of a Research Co-ordination Meeting (Nitrogen-15 in Soil-Plant Studies), Organized by the Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture, Sofia, 1-5 December, 1969. p 91-101, 3 tab, 56 ref.

Descriptors: *Radiation effects, *Soil-water-plant-relationships, *Soil bacteria, *Nitrogen fixing bacteria, Soil sterilants, Enzymes, Water pollution sources, Fertilizers, Nitrates, Reviews, Stable isotopes, Tracers.
Identifiers: Radiation-sterilization.

Methods for ensuring the efficient utilization of N sources other than nitrate and prevention of their nitrification are essential for efficient fertilizer use and prevention of nitrogen build-up in groundwater. Mechanisms of assimilation of N by plants and the role of microorganisms are studied using radiation-sterilization techniques. Although soils are sterilized by exposure to gamma radiation, enzymes are released and, depending on the dose given, cells may remain capable of carrying out their typical biochemical reactions despite the fact that they can no longer proliferate. The influence of ambient laboratory microorganisms on the results of investigations of the absorption and distribution of nitrate and ammonia in plants grown in solution culture is considered and the desirability of carrying out such studies under sterile conditions is stressed. Sterility is shown to be equally important during the storage of the samples prior

to analysis as during the course of experiments. (See also W72-04448) (Bopp-ORNL)
W72-04450

INFILL OF NUCLEAR RUBBLE CHIMNEYS BY GROUND WATER,
Teledyne Isotopes, Palo Alto, Calif.
Paul R. Fenske, and Robert L. Charnell.
Report NVO-1229-171, UC-41, September 1971. 33 p, 7 fig, 4 ref, append. AEC Contract AT (29-2)-1229.

Descriptors: *Nuclear explosions, *Excavation, *Radioactivity effects, *Groundwater movement, Hydrogeology, Natural recharge, Reservoir construction, Hydraulic conductivity, Water pollution, Path of pollutants, Computer programs.

Infall of the overlying material forms a rubble chimney of low porosity over the void produced by a deep nuclear explosion. The usefulness of the chimney as a reservoir for natural gas or water, or the potential hazard due to mobility of radioactive byproducts of the explosion, depends on the rate of filling with groundwater. A predictive model is formulated by examination of the mechanisms of infill. The model is compared with data from the Greeley and Bilby tests, andprediction is made for Cannikin. A code in FORTRAN for use on an IBM 1130 is given. (Bopp-ORNL)
W72-04451

HYDROLOGIC CONTAMINATION PREDICTION METHODOLOGY,
Teledyne Isotopes, Palo Alto, Calif. Palo Alto Labs.
W. E. Nork.
Report NVO-1229-141, VC-41, May 1970. 4 p. AEC Contract AT (29-2)-1229.

Descriptors: *Nuclear explosions, *Excavation, *Radioactivity effects, *Groundwater movement, Water pollution, Path of pollutants, Hydrogeology, Hydraulic conductivity, Natural recharge.
Identifiers: Radionuclide transport.

Groundwater contamination from an underground nuclear test is predicted. Groundwater flows into the explosion-produced chimney at a rate determined by the hydraulic conductivity of the surrounding rock. Infill usually requires a few years. Then the rate of transport of the explosion-produced radionuclides depends on the chemical exchange retardation by the rock which is obtained from laboratory experiments. An approximate equation for two dimensional transport is given. (Bopp-ORNL)
W72-04453

RADIOACTIVITY TRANSPORT IN WATER. CONTINUOUS RELEASE OF RADIONUCLIDES IN A SMALL SCALE ECOSYSTEM,
Texas Univ., Austin. Center for Research in Water Resources.
For primary bibliographic entry see Field 05C.
W72-04454

REPORT OF OFF-SITE SURVEILLANCE FOR PROJECT CABRIOLET.
Southwestern Radiological Health Lab., Las Vegas, Nev.

Report PNE-959 (TID-4500), May 1971. 69 p, 17 fig, 7 append.

Descriptors: *Nuclear explosions, *Excavation, *Public health, *Radioactivity effects, Iodine radioisotopes, Milk, Fallout, Analytical techniques, Radioactivity techniques, Radioecology, Path of pollutants.
Identifiers: Tungsten radioisotopes.

A 2.5-kiloton nuclear excavation experiment did not yield detectable activity in air, milk, or vegetation samples collected beyond the northern Nevada border, about 330 miles distant. Low activity was detected in snow at Big Timber, Montana, about 700 miles away. The radioactive cloud ramained relatively narrow as it moved northward through Nevada. W-187 was the only isotope detected by gamma scan of livestock water, but no W-187 was found in milk. The maximum estimated dose from I-131 in milk to a hypothetical infant thyroid (110 mrad) occurred at a ranch near Deeth, Nevada, at about 260 miles. The highest possible thyroid dose to a SWRHL monitor stationed at about 65 miles was 34 mrad from I-133. The highest external exposure from cloud passage in the off-site area was 12 mrad. (Bopp-ORNL)
W72-04455

ACTIVITY RELEASE AND CONTROL AT THE NUCLEAR POWER STATIONS KWL LINGEN, KRB GUNDREMMINGEN, VAK KAHL AND KWO OBRIGHEIM,
R. Bodege, N. Eickelpasch, A. Grau, and W. Stephan.
Available from the National Technical Information Service Springfield, Va. 22151, as A/CONF.49/P/396. Report A/CONF.49/P/396, APril 1971, Fourth United Nations International Conference on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6-16 September 1971. 19 p, 2 fig, 6 tab, 2 ref.

Descriptors: *Nuclear reactors, *Nuclear powerplants, *Nuclear wastes, *Radiation, *Radioactive waste disposal, *Waste treatment, Effluent, Population, Radioactive effect, Measurement, Water pollution, Water pollution sources, Regulation.
Identifiers: Concentration, Dose rate, Dosimetry, Population exposure.

The amount of activity to be handled in nuclear power stations is determined by the activity content in the primary water, which depends on the corrosion products and on nuclides like xenon, krypton, iodine and caesium, which may be released through fuel clad defects. In nuclear power stations, lots of water with different qualities and radioactivity concentrations flow to the treatment plants. Some lots can be cleaned and fed back into the system, some are discharged into the river system with or without treatment. An increase of the dose rates in the vicinity of the power plants could not be detected with deposited glass dosimeters. Samples taken periodically from ground water, surface water, plants, soil, sediments from the river, micro-organisms and food did not show any activity increases which could be attributed to any influences of the nuclear power stations. (Houser-ORNL)
W72-04457

NATURAL CESIUM IN SEAWATER,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 05A.
W72-04459

THE RECENT WASTE MANAGEMENT PROGRAMME IN JAPAN AND THE STUDIES OF THE BEHAVIOR OF RADIONUCLIDES IN THE MARINE ENVIRONMENT FOR HAZARD EVALUATION OF SEA WASTE DISPOSAL,
National Inst. of Radiological Sciences, Tokyo (Japan).
For primary bibliographic entry see Field 05C.
W72-04462

COLUMBIA RIVER STUDIES ANNUAL PROGRESS REPORT (1970-1971),
Washington Univ., Seattle. Lab. of Radiation Ecology.
For primary bibliographic entry see Field 05C.
W72-04464

RADIOLOGICAL CONDITIONS AND EFFLUENT RELEASES AT CENTRAL ELECTRICITY GENERATING BOARD NUCLEAR STATIONS: A COMPARISON BETWEEN DESIGN FORECASTS AND OPERATIONAL EXPERIENCE,
Central Electricity Generating Board, London (England).
R. B. Pepper, and P. A. Carter.
Available from the National Technical Information Service as A/CONF.49/P/505, $3.00 in paper copy, $0.95 in microfiche. Report A/CONF.49/P/505, May 1971. Fourth International Conference on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, September 6, 1971. 10 p, 7 tab, 9 ref.

Descriptors: *Nuclear powerplants, *Effluents, Air pollution, *Water pollution, *Water pollution sources, Concrete construction, Steel, Comparative benefits.
Identifiers: Personnel exposure, Population exposure, United Kingdom.

Containment and release figures for two types of pressure vessels - steel vs concrete are reported. Dose rates are given from the various sources of radiation. Effluent from waste ponds offer some problem when discharged into streams. However, these remain below acceptable levels. (Houser-ORNL)
W72-04465

RADIONUCLIDE MIGRATION IN FORESTS AND RADIATION EFFECTS ON WOODY PLANTS,
Ministerstvo Vysshego i Srednego Spetsialnogo Obrazovaniya, Moscow (USSR).
For primary bibliographic entry see Field 05C.
W72-04466

RADIOACTIVE WASTE DISCHARGES TO THE ENVIRONMENT FROM NUCLEAR POWER FACILITIES, ADDENDUM-1,
Environmental Protection Agency, Washington, D.C. Office of Radiation Programs.
Joe E. Logsdon, and Thomas L. Robinson.
Available from the National Technical Information Service as ORP/SID 71-1, $3.00 in paper copy, $0.95 in microfiche. Addendum-1 to BHR/DER 70-2, October 1971. 29 p, 3 fig, 11 tab, 38 ref, 4 append.

Descriptors: *Nuclear powerplants, *Nuclear reactors, *Radioactivity, *Nuclear wastes, *Facilities, *Effluents, Discharge measurement, Discharge, Gases, Liquid, Waste water pollution, Water pollution, Water pollution sources, Population, Food chains.
Identifiers: Population exposure, Dietary habit, Concentration.

Discharges through 1968 of liquid and gaseous radioactive wastes from nine nuclear power facilities are summarized. A general discussion of the sources, types and trends of liquid and gaseous wastes, the administrative controls, and the operating experience for the nine nuclear power stations is included. Various tables and charts summarize the characteristics of the facilities and their discharges. This addendum to the report updates the tables and charts through 1970. It also provides data for one additional pressurized water reactor (PWR), and three additional boiling water reactor (BWR) plants: Robert E. Ginna (PWR), La Crosse (BWR), Nine Mile Point (BWR), and Oyster Creek (BWR). Included is an appendix for each facility, which describes the characteristics of the plant and its discharge limits, and provides a brief history of its operation. The appendices also includes graphs of discharges, power production, and maintenance operations as a function of time. This addendum provides appendices for the four additional facilities not included in the original report. However, the graphs of discharges, power production, and maintenance operations of the new facilities are not included because the plants have not operated long enough for trends to develop. (Houser-ORNL)
W72-04470

PLUTONIUM IN NATURAL WATERS,
Mound Lab., Miamisburg, Ohio.
For primary bibliographic entry see Field 05A.
W72-04471

ENVIRONMENTAL EXPOSURE BY RADIONUCLIDES IN GASEOUS AND LIQUID EFFLUENTS FROM NUCLEAR POWER PLANTS IN THE FEDERAL REPUBLIC OF GERMANY,
Bundesgesundheitsamt, Berlin (West Germany).
For primary bibliographic entry see Field 05C.
W72-04472

STRONTIUM-90 AND CESIUM-137 IN THE AUSTRALIAN ENVIRONMENT DURING 1969 AND SOME RESULTS FOR 1970,
Atomic Weapons Tests Safety Committee, Asoct Vale (Australia).
W. J. Gibbs, and J. Bonnyman.
Available from the National Technical Information Service as AWTSC No. 2, $3.00 in paper copy, $0.95 in microfiche. Report AWTSC-2, May 1971. 42 p.

Descriptors: *Radioactivity, *Fallout, *Atmospheric pollution, *Water pollution, *Water pollution sources, *Water pollution effects, Population, Food chains, Cesium, Strontium.
Identifiers: Weapons testing, Surveillance program, Survey radiation.

Measurements are reported on strontium 90 and cesium 137 in Australia for 1969 and 1970. The measurements were made in a continuing survey of the Australian environment in progress since 1957. These long-lived radioisotopes from nuclear weapons tests were monitored in fallout deposition from the atmosphere, in key foodstuffs and in representative members of the population. Any effect of strontium 90 on individuals in the population results from the radiation doses it delivers to bone tissue, after ingestion in foodstuffs. During 1969 these radiation doses to Australians corresponded to less than 2 per cent of the average annual background radiation from natural sources. The most important effect of cesium 137 is of consequence to the whole population rather than to the individual as it results from irradiation of the reproductive cells, potentially affecting the hereditary material. During 1970, these radiation doses to Australians due to cesium 137 both in their bodies and in the environment, corresponded to less than 1 per cent of the average annual background radiation from natural sources. (Houser-ORNL)
W72-04473

DYNAMICS OF THE FORAGE-COW-MILK-PATHWAY FOR TRANSFER OF RADIOACTIVE IODINE, STRONTIUM, AND CESIUM TO MAN,
Oak Ridge National Lab., Tenn.
R. S. Booth, O. W. Burke, and S. V. Kaye.
Available from the National Technical Information Service as CONF. 710818-2, $3.00 in paper copy, $0.95 in microfiche. From: Meeting on Nuclear Methods in Environmental Research, Columbia, Mo., August 23, 1971. 17 p.

Descriptors: *Fallout, *Strontium radioisotopes, *Cesium, *Iodine radioisotopes, *Pollutants, *Path of pollutants, *Food chain, Human population, Vegetation, Pasture management, Milk, Radioactivity effect, Radioecology.
Identifiers: Critical nuclide pathway, Concentration, Contamination.

A systems analysis model was developed to predict the time-dependent concentration of radiostrontium, radiocesium, and radioiodine in the milk, meat, and soft tissue of cows that forage a pasture contaminated by fallout. The variables in this model are adjustable to a wide variation in weather conditions, ecological conditions, and countermeasures. Simulated concentrations were based on reasonable, conservative parameters derived completely from published measurements. There was continued contamination of the milk and meat several weeks after a short-term deposition of the grass (radioactive cloud above the pasture for 1 hr). However, the concentration of milk was in transient equilibrium with the grass (a 14-day environmental half-time for loss of radioactivity from the grass was specified) within a week after the deposition, and the majority of man's uptake of radioactivity from consumption of milk and meat was accomplished within the first few weeks after deposition. The transfer of radioactivity to man was almost exclusively via the direct grass to cow gut to cow blood (body fluid) to meat and to milk pathway. The predicted equilibrium concentrations indicate the potential uptake by man from a continuous source of radioactivity above the pasture. (Houser-ORNL)
W72-04474

OPERATIONAL MONITORING OF RADIOACTIVE LIQUID MEDIA BASED ON GAMMA RADIATION,
L. M. Isakov, B. V. Novikov, and G. I. El'tsin.
Available from the National Technical Information Service as CONF.-710705-10, $3.00 in paper copy, $0.95 in microfiche. Translated from International Symposium on Rapid Methods for Measuring Radioactivity in the Environment; Munich, Germany, July 5, 1971. 8 p.

Descriptors: *Measurements, *Radioactivity, *Radiosensitivity, *Pollutants, *Water pollution sources, *Path of pollutant, *Water analysis, *Radioisotope, Food chain, Diffusion, Dispersion, Potable water.
Identifiers: Critical nuclide pathway, Concentration.

Monitoring of the specific volumetric activity of liquids of the environment (primarily water) is one of the most pressing problems of practical radiometry. The importance of this monitoring is associated especially with the extensive migration of radioactivity in aqueous media, due to which there is a constant intake of radioactivity into the human body through drinking water, fish, and seafood. The measurement of the activity of liquids on the basis of gamma-radiation plays an important role in solving these problems. These measurements are necessary in many problems of monitoring the activity of liquids of the environment, for example in monitoring activity through the walls of broken communication tubes, on the surface of liquids, under the presence of pure gamma emitters in the liquid, etc. The pressing requirements in such monitoring are for speed and reliability of measurements of the specific volumetric activity of liquids. It should be emphasized that speed of measurement should be considered only in conjunction with reliability. Both aspects are discussed. (Houser-ORNL)
W72-04475

ROUTINE ENVIRONMENTAL SURVEILLANCE PROGRAM: MASTER SCHEDULE - FY 1971,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
J. P. Corley.
Available from the National Technical Information Service as BNWL-B-136, $3.00 in paper copy, $0.95 in microfiche. BNWL-B-136, September 1971. 28 p.

Descriptors: *Surveys, *Data collections, *Environment, *Environmental effects, *Environmental sanitation, *Pollutants, Air pollution, Soil contamination, Water pollution, Water pollution sources, Pollution abatement, Animal population, Aquatic population, Food chains, Evaluation.
Identifiers: Surveillance program, Concentration, Radiation safety and control.

The current schedule of data collection is provided for the routine environmental surveillance program at the Hanford plant conducted by Environmental Evaluations for the Atomic Energy Commission. Much of the data collected is available in routine reports issued by the Environmental Evaluations staff. Data from sampling locations within the plant boundaries are presented in the Annual 'Environmental Status of the Hanford Reservations for ...' report series. Data from off-plant locations are presented in the annual 'Evaluation of Radiological Conditions in the Vicinity of Hanford for ...' series of reports. (Houser-ORNL)
W72-04476

TRANSFER OF RADIOACTIVE MATERIALS FROM THE TERRESTRIAL ENVIRONMENT TO ANIMALS AND MAN,
Collaborative Radiological Health Animal Research Lab., Fort Collins, Colo.
R. J. Garner.
CRC Critical Reviews in Environmental Control, Vol 2, No 3, p 337-385 (1971). 255 ref.

Descriptors: *Water pollution effects, *Food chains, *Radioactivity effects, Nuclear powerplants, Path of pollutants, Tritium, Uranium radioisotopes, Strontium radioisotopes, Diets, Toxicity, Public health, Nuclear wastes, On-site investigations, Iodine radioisotopes, Reviews.
Identifiers: Krypton radioisotopes, Cessium radioisotopes, Polonium radioisotopes.

Literature on pathways of radionuclides to the biosphere is reviewed since publication of Radioactivity and Human Diet (edited by R.S. Russell, 1966). I-131, Sr-90, Cs-137, other manmade radionuclides, and natural radionuclides of the uranium and thorium series are dealt with. For accuracy a field study is required to estimate the consequences of any specific contamination event. Dose estimates (mrem/year) are given for: the whole body from natural sources (79), internal from K-40 (20), internal for reindeer-herding Lapps from Po-210 (100), the whole body from the nuclear power program by the year 2000 from tritium (0.06) and from Kr-85 (0.02). (Bopp-ORNL)
W72-04477

MANAGEMENT OF RADIOACTIVE EFFLUENTS FROM NUCLEAR POWER STATION CURRENTLY UNDER OPERATION IN JAPAN AND ENVIRONMENTAL MONITORING,
Tokyo Electric Power Corp. (Japan).
S. Hamayuchi, and C. Asada.
Available from the National Technical Information Service as A/CONF.49/P/253, $3.00 in paper copy, $0.95 in microfiche. Report A/CONF.49/P/253, May 1971, Fourth United Nations International Conference on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6-16 September 1971. 10 p, 1 tab.

Descriptors: *Nuclear powerplants, *Effluents, *Radioactive wastes, *Nuclear wastes, *Water pollution, *Water pollution sources, Regulation, Administrative agencies, Evaporation, Environmental effects, Monitoring, Safety, Public health, Toxicity, Standards.
Identifiers: Administrative control, Concentration, Contamination, Dosimetry, Waste storage, Containment, *Japan.

Discharge of radioactive effluents from nuclear power plants in Japan is government regulated and is based upon the permissible value of the ICRP recommendations, but design and operation of these plants have been in accordance with the principle of 'as low as practicable.' An off-gas release limit has been determined to keep the annual exposure dose at the site boundary resulting from off-gas release at a level as low as the natural background. For instance, off-gas decay tanks with a 24 hour hold up capacity have been adopted at the BWR station. Radioactive liquid effluents (except very low level effluents) have been solidified by an evaporator and therefore have not been discharged to the sea in consideration of possible concentration effects on aquatic life. Concerning environmental monitoring, an organization established in Japan enables a plant

operator to conduct his radiation monitoring and evaluate its results in cooperation with local administrative organizations, keeping the public well informed on a safety of radiation level in the environment. (Houser-ORNL)
W72-04481

RADIOACTIVITY OF OCEAN WATERS AND BEHAVIOR OF SOME FISSION PRODUCTS,
Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow.
W. M. Vdovenko, A. G. Kolesnikov, V. I. Spitsyn, R. N. Bernovskaya, and L. I. Gedeunov.
Available from the National Technical Information Service as A/CONF.49/P/457, $3.00 in paper copy, $0.95 in microfiche. Report A/CONF.49/P/457, June 1971, Fourth United Nations International Conf. on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6-16 September 1971. 32 p, 10 fig, 5 tab, 36 ref.

Descriptors: *Sea water, *Atlantic Ocean, *Pacific Ocean, *Wastes, *Water pollution, *Water pollution sources, Fallout, Radioisotopes, Strontium, Acidity, Absorption, Adsorption, Water pollution effects, Nuclear wastes.
Identifiers: Concentration, Comtamination, pH effect, Radioactivity survey, Surveillance program.

The results presented here together with data reported previously give a pattern of radioactive contamination of the World Ocean in 1966-1967. The initial situation for investigations of radioactivity is given for each region studied for the first time. Physical, chemical, and biological processes governing the behaviour of radionuclides disposed into the ocean are studied to get an understanding of what can happen to the ocean and its resources. Hydrolysis, complex formation, and sorption on ocean suspension play major roles in the case of soluble compounds. Uptake of artificial radionuclides into active biological circulation can cause accumulation effects in certain links of the migration chain. Carbonateless clay silt is the best radionuclide absorber among all bottom sediments investigated. The removal of the radionuclides from sea water appeared to be due to a combination of mechanical capture of colloid particles containing these elements and sorption of a truly solvated fraction of them by bottom sediments. (Houser-ORNL)
W72-04482

RADIOACTIVITY IN THE MARINE ENVIRONMENT.
National Academy of Sciences-National Research Council, Washington, D. C. Committee on Oceanography; and National Academy of Sciences-National Research Council, Washington, D. C. Panel on Radioactivity in the Marine E nvironment.

National Academy of Sciences, Washington, D.C., 1971. $12.50. 272 p.

Descriptors: *Estuarine environment, *Aquatic life, *Radioisotopes, *Absorption, Trace elements, Nutrients, Trophic level, Nuclear explosions, Water pollution sources, Water pollution effects, Radioactivity effects, Reviews, Environmental effects, Food chains, Marine microorganisms, Deposition (Sediments), Cycling nutrients, Metabolism, Path of pollutants, Fallout, Nuclear wastes.
Identifiers: Radionuclide uptake.

Nine reviews were prepared by the Panel on Radioactivity in the Marine Environment of the National Research Council's Committee on Oceanography. Topics reviewed are fallout and nuclear-waste radionuclide sources, fallout distribution, ocean mixing, marine chemistry, sorption by sediments, radionuclide uptake by organisms, radioactivity effects on ecology, radiation effects on organisms, and prediction of exposures to man. The critical-pathway and specific-activity approaches to exposure prediction are described. The former is of general applicability when sufficient data is available. The latter limits the specific activity of the seawater to the permissible specific activity of the critical organ. The specific-activity approach is conservative except when the radionuclide and the stable nuclides of that element are present in the water in different chemical forms, or when the nuclides are in insoluble form. (See also W72-04485 thru W72-04493) (Bopp-ORNL)
W72-04484

SOURCES OF RADIOACTIVITY AND THEIR CHARACTERISTICS,
A. B. Joseph, P. F. Gutafson, I. R. Russell, A. E. Schuert, and H. L. Volchok.
In: Radioactivity in the Marine Environment, National Academy of Sciences, Washington, D.C. 1971, p 6-41, 7 fig, 25 tab, 84 ref.

Descriptors: *Nuclear wastes, *Water pollution sources, *Oceans, *Aquatic life, Estuarine environment, Reviews, Fallout, Ultimate disposal, Radioactivity effects, Water pollution effects, Path of pollutants, Deposition (Sediments), Nuclear explosions, Waste treatment, Waste disposal, Separation techniques, Ion exchange, Radioisotopes, Meteorology, Oceanography, Nuclear powerplants.

Natural atmospheric and geologic processes issue discrete radionuclides. Nuclear energy uses (explosions of various types, power reactors, fuel reprocessing, ship and space vehicle propulsion, and auxiliary power generators) involve nuclear wastes. The biological distribution in the ocean of man-made radionuclides depends on the initial physicochemical form. Data is given with regard to disposal of packaged wastes at sea (disposal locations, types and numbers of containers). Studies as to the fate of wastes are referenced. (See also W72-04484) (Bopp-ORNL)
W72-04485

OCEANIC DISTRIBUTIONS OF RADIONUCLIDES FROM NUCLEAR EXPLOSIONS,
H. L. Volchok, V. T. Bowen, T. R. Folsom, E. A. Broecker, and E. A. Schuert.
In: Radioactivity in the Marine Environment, National Academy of Sciences, Washington, D.C. 1971, p 42-89. 5 fig, 21 tab, 360 ref.

Descriptors: *Oceanography, *Path of pollutants, *Radioisotopes, *Strontium radioisotopes, Tritium, Carbon radioisotopes, Ocean circulation, Weather modification, Fallout, Columbia River, Thermocline, Deposition (Sediments), Water pollution effects, Water pollution sources, Reviews, Radioactivity techniques.
Identifiers: Cesium radioisotopes.

The ratio Sr-90/Cs-137 averages about 1.5 in the oceans, and is independent of depth. Sr-90 decreases with depth, exceeding 10% of the surface value at 700 m. Three different interpretations concerning the deep water concentration are given. Most of the concentrations observed in deep water appear excessive, since they would indicate too large a value for the world inventory. In the eastern equatorial Atlantic, the thermocline appears to insulate the deeper layers from tritium penetration, but in other areas there is penetration to 2000 m. Data for radiocarbon in the eastern Pacific suggests a relationship between weather and mixing. The lanthanides, as well as Zr and Nb, are largely associated with particles and exhibit similar profiles with depth. (See also W72-04484) (Bopp-ORNL)
W72-04486

PHYSICAL PROCESSES OF WATER MOVEMENT AND MIXING,
D. W. Pritchard, R. O. Reid, A. Okubo, and H. H. Carter.
In: Radioactivity in the Marine Environment, National Academy of Sciences, Washington, D.C. 1971, p 90-136. 29 fig, 8 tab, 127 ref.

Descriptors: *Fallout, *Ocean circulation, *Estuarine environment, *Path of pollutants, Radioisotopes, Mixing, Turbulence, Saline water-freshwater interfaces, Convection, Diffusion, Dispersion, Waste dilution, Water pollution sources, Strontium radioisotopes, Carbon radioisotopes, Mathematical models, Reviews, Numerical analysis, Nuclear wastes, Waste disposition, Ultimate disposal.
Identifiers: Radionuclide transport, Cesium radioisotopes.

Movement and mixing in the ocean and in coast areas and estuaries is reviewed; and temperature, salinity, and deep and near-surface currents are tabulated. Radionuclide transport is reviewed; including theoretical aspects, box models, and various measurements of Sr-90 and Cs-137 concentration-depth relationships. Variations of C-14 with depth at a location in the northeast Pacific Ocean are used to compute the vertical components of the mean velocity and of the eddy diffusivity. The results of this analysis are in line with those of Munk (Deep-Sea Res. 13, 707-730 (1966) for Sr-90 and Cs-137. The modelling of mixing in estuaries is discussed. (See also W72-04484) (Bopp-ORNL)
W72-04487

MARINE CHEMISTRY,
E. D. Goldberg, W. S. Broecker, M. G. Gross, and K. K. Turekian.
In: Radioactivity in the Marine Environment, National Academy of Sciences, Washington, D.C. 1971. p 137-146. 1 fig, 7 tab, 18 ref.

Descriptors: *Deposition (Sediments), *Physicochemical properties, *Path of pollutants, *Nuclear wastes, Water pollution sources, Lithification, Sedimentation rates, Oceanography, Estuarine environment, Solubility, Chelation, Productivity, Nutrient requirements, Trace elements, Absorption, Radioisotopes, Ion transport, Reviews, Fallout.

The data for the elements is tabulated: average concentrations found both in ocean and stream waters, thermodynamically stable forms, and residence time (the average time between introduction into ocean water and incorporation into sediments). The residence times of elements for which the reactivity of the ions is relatively low (alkali and alkaline earth metals, 1-10 million years) are longer than for elements which are immobilized by biological cycling (P and Si, 1-10 thousand years) or for elements primarily associated with lithogenous particles (Al, Ti, and Th; 0.1-10 thousand years). It is shown that the concentrations in ocean water are dominated by phenomena other than solubility or stability of complexes. Factors are enumerated which account for differences in sedimentation between the coastal and open oceans. (See also W72-04484) (Bopp-ORNL)
W72-04488

MARINE SEDIMENTS AND RADIOACTIVITY,
E. K. Duursma, and M. G. Gross.
In: Radioactivity in the Marine Environment, National Academy of Sciences, Washington, D.C. 1971. p 147-160. 13 fig, 2 tab, 54 ref.

Descriptors: *Deposition (Sediments), *Bottom sediments, *Nuclear wastes, *Radioisotopes, Reviews, Sedimentation rates, Soil water movement, Interstices, Hydraulic conductivity, Groundwater movement, Diffusion, Sorption, Absorption, Waste water treatment, Estuarine environment, Oceans, Path of pollutants, Ion exchange, Sediment transport, Physicochemical properties, Sediment-water interfaces.

Dependence of radionuclide sorption by sediments on physico-chemical conditions and history of the sediment-water conditions may make prediction

difficult. Often sedimentation is sufficiently slow that diffusion through the interstitial water is the dominant mechanism of radionuclide movement through sediments as compared with removal with interstitial water during sediment compaction or discharge into ground-water in the sea bottom. Alternately, radionuclide movement through sediments may be effected by the burrowing activity of benthic organisms, near-bottom currents, or wave action. A calculation using distribution coefficients which are tabulated suggests the practability of scavenging radionuclides from nuclear-waste effluents by repeated suspension and settling. (See also W72-04484) (Bopp-ORNL)
W72-04489

ACCUMULATION AND REDISTRIBUTION OF RADIONUCLIDES BY MARINE ORGANISMS,
F. G. Lowman, T. R. Rice, and F. A. Richards.
In: Radioactivity in the Marine Environment, National Academy of Sciences, Washington, D.C. 1971. p 161-199, 5 fig, 8 tab, 191 ref.

Descriptors: *Estuarine environment, *Aquatic life, *Radioisotopes, *Absorption, Trace elements, Nutrients, Trophic level, Nuclear explosions, Water pollution sources, Water pollution effects, Radioactivity effects, Reviews, Environmental effects, Food chains, Marine microorganisms, Deposition (Sediments), Cycling nutrients, Metabolism, Path of pollutants, Fallout, Nuclear wastes.
Identifiers: Radionuclide uptake.

Marine organisms may affect the seasonal, horizontal, and vertical distributions of natural and man-introduced trace elements. Availability to the biota of radionuclides depends on the type of nuclear explosion and on environmental and biological factors. The large mass of biota at the lower trophic levels concentrates nutrient elements and (to varying degrees) heavy divalent ions, heavy halogens, and elements easily hydrolyzed at seawater pH. Sinking detritus enhances sedimentation, accounting for the increase in nutrient elements with increased depth. In estuarine regions, where bottom sediments are close to the sites of photosynthesis and to sources of radionuclide contaminants, large populations of sessile feeders may affect radionuclide sedimentation. (See also W72-04484) (Bopp-ORNL)
W72-04490

ECOLOGICAL INTERACTIONS OF MARINE RADIOACTIVITY,
V. T. Bowen, J. S. Olsen, C. L. Osterberg, and J. Ravera.
In: Radioactivity in the Marine Environment, National Academy of Sciences, Washington, D.C. 1971, p 200-222. 1 fig, 2 tab, 157 ref.

Descriptors: *Estuarine environment, *Aquatic life, *Radioisotopes, *Absorption, Trophic level, Cycling nutrients, Fallout, Nuclear wastes, Radioecology, Water pollution sources, Water pollution effects, Radioactivity effects, Reviews, Food chains, Model studies, Mathematical models, Ecosystems, Physicochemical properties, Physiological ecology, Deposition (Sediments), Systems analysis, Path of pollutants.
Identifiers: Radionuclide uptake.

Continual refinement of computer modelling of ecosystems is needed as furthe basic data is obtained. Either the specific-activity or the critical-pathway concepts may be used to establish the permissible concentration level. Recent data on high Ra-226 and Po-210 contents in marine organisms is not yet well established. Pelagic and benthic ecosystems are further removed from contaminants, excepting worldwide fallout and certain nuclear submarine accidents, than near-shore ecosystems; but may be contaminated by nuclear waste disposal in the future. The high radionuclide concentration at the low trophic levels may become of even greater consequence in the future, if the use of such organisms as food by man increases. It may be possible to lower the radionuclide of fish pastes during processing. (See also W72-04484) (Bopp-ORNL)
W72-04491

RADIATION EFFECTS,
W. L. Templeton, R. E. Nakatani, and E. E. Held.
In: Radioactivity in the Marine Environment, National Academy of Sciences, Washington, D.C. 1971, p 223-239. 5 fig, 6 tab, 109 ref.

Descriptors: *Radioactivity effects, *Nuclear wastes, *Aquatic life, *Marine animals, Fish, Marine fish, Fish eggs, Growth stages, Embryonic growth stage, Estuarine environment, Physiological ecology, Water pollution effects, Deposition (Sediments), Reviews, Radioisotopes, Absorption, Trophic level, Nuclear explosions, Fallout, Columbia River, Pacific Ocean, Environmental effects, Fish genetics, Genetics.

Exclusive of the eggs of fish and the larvae of invertebrates and fish, most marine organisms are relatively radioresistant. The dose necessary to evoke an unequivocally detectable biological response is 100-1000 times that of environmental concentrations of radionuclides (with the possible exception of some limited data). Results are summarized of studies at the Pacific Testing Grounds, in the Irish Sea, and in the Columbia River. Studies on genetic consequences of population exposure indicate that, despite larger numbers of mutations, increased utilization of reproductive capacity maintains a population at preradiation density. Lethal amounts of acute radiation differ widely among marine organisms, according to species, age, physiological status, body size, temperature, and salinity. (See also W72-04484) (Bopp-ORNL)
W72-04492

EVALUATION OF HUMAN RADIATION EXPOSURE,
R. F. Foster, I. L. Ophel, and A. Preston.
In: Radioactivity in the Marine Environment, National Academy of Sciences, Washington, D.C. 1971, p 240-260. 4 fig, 4 tab, 72 ref.

Descriptors: *Radioisotopes, *Nuclear wastes, *Food chains, *Absorption, Mathematical models, On-site investigations, Analytical techniques, Systems analysis, Radioecology, Estuarine environment, Aquatic life, Deposition (Sediments), Metabolism, Path of pollutants, Nutrients, Public health, Water pollution sources, Water pollution effects, Radioactivity effects, Radioactivity techniques, Reviews.

Preoperational identification of the probable critical pathway and the individuals who receive the greatest exposure permits establishment of maximum permissible discharge rates for nuclear wastes. Re-evaluation should be made from on-site measurements of fish, shellfish, seaweed, beaches, etc. Usually, such measurements have shown the predictions were pessimistic. The critical pathways via seafood are described for several installations in the United Kingdom and for power reactors at Humbolt Bay, California, and Tarapur, India. Critical radionuclides are often Zn-65, Co-60, P-32, and Ru-106 which are concentrated by marine organisms. (See also W72-04484) (Bopp-ORNL)
W72-04493

BIOLOGICAL CONCENTRATION OF PESTICIDES BY ALGAE,
North Texas State Univ., Denton. Department of Biology.
B. D. Vance, and W. Drummond.
Journal of the American Water Works Association, Vol 61, No 7, p 360-362, July 1969. 2 tab, 11 ref.

Descriptors: *Water quality, *Algae, *Pesticides, *Fish, *Fish kills, *Rotifers, *Ecology, *Ecosystems.
Identifiers: *Potentiation, *Organic degradation.

Algae are extremely efficient potentiators of pesticide residues. Concentration of many pesticides by certain algae occurs quite rapidly, and there is apparently very little, if any, degradation by the algae. Therefore these highly concentrated residues can be biologically transferred to higher members of the food chain such as rotifers and small fish. Most higher members do not appear to be nearly as resistant as the algae to these chlorinated compounds. Consequently, fish kills and similar catastrophies may be brought about in water containing as little as 1 ppb of a pesticide. Such potentiation and biological transfer has been amply demonstrated, beginning with fish and continuing up the food chain to man. It is important to know the effects of such chemicals upon ecosystems and how such chlorinated hydrocarbon molecules may influence the basic ecology of our environment. It was thought at one time that insecticides did not cause death in plants, even in gross over-dosages. However, tests show that Dieldrin, Aldrin, and Endrin are algicidal to M. aeruginosa at a concentration of less than 5 ng/ml. (Bean-AWWA)
W72-04506

THE PHYSICS OF FINE-PARTICLE MOVEMENT THROUGH PERMEABLE AQUIFERS,
Westinghouse Electric Corp., Pittsburgh, Pa.
J. B. F. Champlin.
Society of Petroleum Engineers Journal, Vol 11, No 4, p 367-373, December 1971. 9 fig, 3 tab, 11 ref.

Descriptors: *Groundwater movement, *Fine aggregates, *Porous media, *Aquifers, *Water pollution sources, Tracking techniques, Tracers, Minerology, Ions, Ion transport.

Experimental work shows close alliance between the relative movement of both trace ions and particles and the over-all concentration of common salts dissolved in groundwater. Most importantly, the spacial stability of fine particles such as the sesquioxides and the clays in formations is dependent on the nature of the anionic portion of the dominant salt in solution. These results have great potential, applied in exploration programs for minerals. Not only do they provide answers for particulate migration problems in the oil fields and ore concentration mechanisms in the uranium deposits, but also they explain the untoward migration of certain radioisotopes from waste storage ponds or cribs at the national reactor-fuel reprocessing plants. By careful development and engineering practice, fine particles tagged with almost any radioactive or activatable ion may become one of the most useful tools in tracing subsurface movement of fluids. (Woodard-USGS)
W72-04537

HEAVY METAL CONCENTRATION IN COASTAL WATERS,
Liverpool Univ. (England). Dept. of Oceanography.
M. I. Abdullah, L. G. Royle, and A. W. Morris.
Nature, Vol 235, No 5334, p 158-160, January 21, 1972. 1 fig, 1 tab, 2 ref.

Descriptors: *Heavy metals, *Water pollution sources, *Chemical analysis, *Data collections, *Bays, Estuaries, Copper, Industrial wastes, Domestic wastes, Mine wastes.
Identifiers: Great Britain, Lead, Cadmium, Zinc.

The levels and distribution of some trace metals presented for Liverpool Bay, Cardigan Bay, and the Bristol Channel in Great Britain are part of a survey made during the period 1969-1971. The concentration levels and distribution of copper, lead, cadmium and zinc are tabulated. The levels of these metals decrease outwards in all the three regions to a level comparable with average seawater. There is also a significant buildup of trace metals within these regions, particularly near the River Mersey and the River Ribble, in Tremadoc Bay and in the eastern part of the Bristol Channel. This buildup seems to be controlled by both effluent and the circulation of water in the regions. The

high concentrations of lead in Liverpool Bay are attributed to the runoff from north Wales, the effluent from the Mersey and Ribble and from activities on the Isle of Man. A large area of the Bay is characterized by a high zinc concentration, five to ten times its concentration in the open seawater of the region. (Woodard-USGS)
W72-04539

MANAGEMENT OF OPTIMUM WATER QUALITY IN A STREAM,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering.
L. T. Fan, R. S. Nadkarni, and L. E. Erickson.
Water Research, Vol 5, No 11, p 1005-1021, November, 1971. 10 fig, 6 tab, 16 ref.

Descriptors: *Optimization, *Biochemical oxygen demand, *Dissolved oxygen, *Cost-benefit analysis, Streams, Dispersion, Water quality, Model studies.

An optimal waste discharge policy along a stream was investigated based on a program of minimizing the total cost benefit function on a regional basis. The system consisted of a stream along which were located several inputs of waste and intakes of water. The cost benefit function was comprised of the sum of the cost of waste treatment and the cost of water treatment minus the benefits derived from maintaining a certain water quality in the stream. The biochemical oxygen demand and the dissolved oxygen were considered to be the primary indicators of water quality. A steady state dispersion model was employed to predict BOD and DO concentrations along the stream. In order to optimize the system or minimize the cost benefit function within certain constraints on water quality, a search scheme was proposed. The feasibility of obtaining a solution by a sequential minimization technique, employing a discrete search, was studied for cases with two and three decision variables. The analysis procedure could be used to examine existing water quality programs and to study the influence of alternate policies and constraints. (Ligon-Cornell)
W72-04545

THE NATIONAL MANAGEMENT OF WATER RESOURCES,
Water Resources Board of England and Wales.
For primary bibliographic entry see Field 06A.
W72-04546

ESTUARINE MODELING: AN ASSESSMENT.
Tracor, Inc., Austin, Tex.
For primary bibliographic entry see Field 02L.
W72-04555

WATER POLLUTION POTENTIAL OF SPENT OIL SHALE RESIDUES.
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 05E.
W72-04556

SIMULTANEOUS QUANTITATION OF SALMONELLA SPECIES AND PSEUDOMONAS AERUGINOSA. III. ANALYSIS OF WASTE TREATMENT SLUDGES FOR SALMONELLA SPECIES AS A SURVEILLANCE TOOL,
National Environmental Research Center, Cincinnati, Ohio.
For primary bibliographic entry see Field 05A.
W72-04561

CATTLE FEEDLOTS AND ALTERNATIVES FOR WASTE MANAGEMENT,
Environmental Protection Agency, Portland, Oreg. Water Quality Office.
For primary bibliographic entry see Field 05G.
W72-04569

TRANSPORT EQUATION STABILITY AND ESTUARY MODELING,
Union Coll., Schenectady, N.Y. Dept. of Mechanical Engineering.
F. G. Haag, and K. W. Bedford.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY12, Paper 8610, p 2051-2066, December 1971. 9 fig, 1 tab, 12 ref, append.
*OWRR C-1318 (No. 1967) (2) and C-1702 (No. 3157) (1).

Descriptors: *Dispersion, *Path of pollutants, *Estuaries, Mixing, Mathematical models, Turbulence, Turbulent flow, Tides, Saline water intrusion, Streamflow.
Identifiers: Hudson Estuary.

A method is presented for judging the stability of discrete approximations to the estuary mixing equations. It is applicable to unequal as well as equal reach lengths. A mathematical model is developed for the Hudson River Estuary and the model results are compared to the discrete approximation results. (Knapp-USGS)
W72-04577

FLUSHING PATTERN OF CERTAIN TIDAL STREAMS IN DELAWARE,
Delaware Univ., Newark. Coll. of Marine Sciences.
For primary bibliographic entry see Field 02L.
W72-04581

AGRICULTURAL WASTES: PRINCIPLES AND GUIDELINES FOR PRACTICAL SOLUTIONS.
New York State Coll. of Agriculture, Ithaca.
For primary bibliographic entry see Field 05D.
W72-04604

ENVIRONMENTAL QUALITY AND PRODUCTIVITY,
Environmental Protection Agency, Washington, D.C. Water Quality Office.
J. D. Denit.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. p 6-11, 2 tab, 5 ref.

Descriptors: *Farm wastes, *Water quality control, *Surface runoff, Lagoons, Eutrophication, Water pollution sources, Water law.

World needs demand expansion of the already immense American livestock industry. The problem which now confronts the industry is the adverse impact of production wastes on the environment, particularly water quality. Due to the fragmented nature of earlier studies, a definite pattern of animal waste pollution has emerged only in the last two years. Fish kills from feedlot-runoff in Kansas in 1964 was an indicator of the twenty-four kills in twelve states in 1969. The combination of production oriented and traditional zero-cost, waste management philosophies is now leading to severe pollution problems. Anaerobic lagoons are designed on raw waste strength instead of runoff quality. Farmers have not been informed of state Water Quality Standards or their responsibility in meeting them. Even though organic waste loads from lagoons are higher than raw domestic wastes, the concentrations of nitrogen and phosphorus are of greater significance, because no industry is more dependent upon a pure water supply than agriculture. In conserving water quality, the agricultural operator is engaging in notable self-service and making an investment in survival. (See also W72-04604) (Schmitt-Iowa State)
W72-04606

FARM LAND RUNOFF,
Cornell Univ., Ithaca, N.Y. Dept. of Natural Resources.
R. T. Oglesby.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. p 15-19, 11 ref.

Descriptors: *Farm wastes, *Runoff, *Nitrogen compounds, *Phosphorus compounds, Fertilizers, Water quality, Eutrophication, Soil erosion, Water pollution sources.

Agricultural wastes and many materials in agricultural usage are translocated to aquatic systems where some of them cause significant problems. Nitrogen, applied as fertilizer or from manures, leaks from agricultural activities in quantitites sufficient to promote nuisance algal growth in receiving waters where this element is a limiting factor, and many, through accumulation in groundwaters, constitute a health hazard as well. Large quantities of phosphorous are lost in runoff, primarily through erosion of soil-phosphorus particles. The significance of this form of phosphorus in stimulating algal growth is not fully understood but is probably not high. Organically bound phosphorus, such as that occurring in animal wastes, may add significant amounts of this element in a form available to plants. (See also W72-04604) (Schmitt-Iowa State)
W72-04608

ENVIRONMENTAL PROBLEMS IN THE FOOD PROCESSING INDUSTRY,
Cornell Univ., Ithaca, N.Y. Agricultural Experiment Station.
D. L. Downing.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971. p 20-24, 6 tab.

Descriptors: *Farm wastes, *Water pollution sources, *Liquid wastes, Waste water disposal, Industrial wastes, Air pollution.

The food processing industry ranks fifth in the U.S. in the volume of liquid wastes generated, producing about 700 billion gallons annually. This waste contains a high amount of suspended solids of which only part is settleable; therefore, the national food industry ranks first in the amount of suspended solids released to the environment. The BOD5 of food-plant effluent is normally several thousand ppm compared with a few hundred for typical municipal sewage. The pH of food processing wastes range from below 5.0 for sulphur dioxide bleaching processes to about 12.0 for lye peeling of vegetables. Pigments in cannery wastes are very difficult to degrade, often persisting after passing through a municipal treatment plant. Olive, pickle and sauerkraut brine range up to 15% in sodium chloride content. Unlike some industries where waste products can be utilized, most solid wastes from canneries have to be hauled to land-fill type operations. Transmission of plant pathogens is a major reason wastes are not normally spread on the cropland. Adding to the waste problem is the fact that the food industry uses about 50% of all package utilization. Air pollution and noise pollution are still other problems it will take much ingenuity to solve. (See also W72-04604) (Schmitt-Iowa State)
W72-04609

FERTILIZER PRACTICES WHICH MINIMIZE NUTRIENT LOSS,
Cornell Univ., Ithaca, N.Y. Dept. of Agronomy.
D. J. Lathwell, W. S. Reid, and D. R. Bouldin.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, Syracuse, New York. p 25-35, 6 fig, 2 tab, 8 ref.

Descriptors: *Farm wastes, *Fertilization, *Nutrient requirements, Water pollution sources, Crop response, Rates of application, Soil erosion.

Water is the transport agent for nutrients, organic matter, and sediments from agricultural land. The major flow of runoff occurs in the spring when accumulated snow and ice melt. Experimental data demonstrate that the major quantity of nutrient loss occurs during the spring runoff period. The major form of inorganic nitrogen in the soil is usually nitrate, even if ammonium fertilizers are added becuase of the universal occurrence in soil of microorganisms which convert ammonium to nitrate. The nitrate ion is completely dissolved in the soil solution and moves wherever the soil water moves. The nitrate may be leached into the groundwater, into tile drains or into surface runoff. To avoid these losses, moderate amounts of fertilizer nitrogen should be added just before the crop begins its period of minimum growth. If the fertilizer is added too soon, some or most of it may be carried off before the plant can take up the nitrogen. Phosphorus fertilizer reacts rapidly with the soil to form relatively insoluble products. The major source of phosphorus loss from agricultural land is associated with sediment loss. Therefore, control of erosion is essential if phosphorus is to be kept on agricultural land. All of the control measures outlined above are economically feasible. (See also W72-04604) (Schmitt-Iowa State)
W72-04610

EFFECTS OF AGRICULTURAL PRACTICES ON AQUIFERS,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 05C.
W72-04633

OXYGEN CONSUMPTION BY THE SEABED. IV. SHIPBOARD AND LABORABORY EXPERIMENTS,
Washington Univ., Seattle. Dept. of Oceanography.
Mario M. Pamatmat.
Limnology and Oceanography, Vol 16, No 3, p 536-550, May 1971. 6 fig, 4 tab, 27 ref. EPA Program 16070 EKZ.

Descriptors: *Oxidation, Organic matter, Sediments, Dentrification, Hydrostatic pressure, Continental shelf, Pacific Ocean, Measurement, Absorption, Oxygen, Chemical oxygen demand.

A shipboard method for measuring the oxygen uptake of undisturbed cores of sediment with their original overlying water and intact mud-water interface gave the same results as in situ measurements at 22-m depth. Hydrostatic pressures up to 18 atm have no effect on total oxygen uptake of cores from 180-m depth. Partitioning experiments with intact cores show that oxygen uptake by inorganic chemical oxidation is often greater than respiratory consumption; in these experiments the rate of chemical oxidation decreases with decreasing oxygen tension, while the rate of respiration is relatively constant down to a critical oxygen concentration of about 1 ml/liter. Sweeping away the surface layer and exposing subsurface sediment, either in situ or aboard ship, leads to increased rates of oxygen uptake. Where chemical oxidation predominates, the rate of uptake is a function not only of oxygen concentration but also of stirring of the water overlying the sediment. Undisturbed cores where respiration predominates show a constant rate of uptake for many hours, even after cessation of stirring for 1 hr. Presumptive evidence is presented that active denitrification could be taking place as deep as 20-21 cm in the sediment of the continental shelf off Peru. The unknown relationship between chemical oxidation and anaerobic metabolism clouds understanding of the biological meaning of total oxygen uptake by the sediment, but this is still the best measure of the integrated biological activity in the seabed. (EPA abstract)
W72-04635

THE CARBON CYCLE OF A GEORGIA FISH POND,
Georgia Univ., Athens. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W72-04638

GASTROENTERITIS EPIDEMIC OWING TO SEWAGE CONTAMINATION OF PUBLIC WATER SUPPLY,
California State Dept. of Public Health, Berkeley.
G. E. Browning, and J. O. Mankin.
Journal of the American Water Works Association, Vol 58, No 11, p 1465-1470, November 1966. 4 fig, 1 ref.

Descriptors: *Water quality, *Diseases, *Wells, *Epidemics, Public health, *Water pollution, Gophers.
Identifiers: *Gastroentiritis, *Sewage.

In August 1965, a waterborne epidemic of enteritis occurred in Madera, California. There is considerable evidence that the epidemic was a result of sewage contamination of the city's water supply through one of its wells. The direct evidence includes the high coliform counts in the distribution system and the water in Well 14. The indirect evidence includes the demonstration that water could flow from a sewage-irrigated field into Well 14. This epidemic seems to have occurred as a result of several circumstances, some of which are unusual: irrigation of the field with undisinfected sewage, presence of a gopher hole leading in a particular direction, connection between the valve excavation and the well pit, and presence in the pit of openings into the well casing. Measures have been taken to prevent future recurrences. (Bean-AWWA)
W72-04642

CONTAMINATION OF RIVERSIDE, CALIF. SUPPLY,
Riverside Public Utilities Dept., Calif.
E. C. Ross, K. W. Campbell, and H. J. Ongerth.
Journal of the American Water Works Association, Vol 58, No 2, p 165-174, February 1966. 2 fig, 1 ref.

Descriptors: Water treatment, *Public health, *Water quality, *Salmonella, Diseases, Disinfection, *Water pollution.
Identifiers: Riverside (Calif).

In late May and early June 1965 an epidemic of gastroenteritis affected an estimated 18,000 people in and near Riverside, California. Salmonella typhimurium was identified as the cause. Based upon routine testing, the coliform counts in the city water were negative, indicating no contamination. However, a survey indicated that the only common source was water. More than 1500 water samples were tested for Salmonella by Oct. 25. The first positive Salmonella sample was collected on May 30 and the last on July 21. A total of only 15 samples contained Salmonella - at least six of which had a coliform content of less than 2.2. Various hypotheses as to the source of the Salmonella are discussed. No serious defects were located. However, the State Dept. of Public Health requested the Riverside water system to chlorinate continuously all well sources, to augment its cross-connection control program, and to step up its routine coliform-sampling program. (Bean-AWWA)
W72-04643

GROUND-WATER POLLUTION AND SANITARY LANDFILLS--A CRITICAL REVIEW,
Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.
A. E. Zanoni.
Ground Water, Vol 10, No 1, p 3-13, January-February 1972. 61 ref.

Descriptors: *Reviews, *Landfills, *Water pollution sources, *Path of pollutants, Garbage dumps, Waste disposal, Water pollution control, Public health, Sanitary engineering.
Identifiers: Urban hydrology, Groundwater pollution.

Important studies concerned with the groundwater pollution potential from sanitary landfills and dump grounds were conducted in California, South Dakota, Illinois and England. These studies demonstrate that leachates are highly pollutional in characteristics, but once they pass into the surrounding soil regime, the attenuation mechanisms of dilution, adsorption and microbial degradation tend to reduce their impact on underground water. A survey of practice in twenty-one States in the United States regarding groundwater pollution from landfill operation shows that not much new research is underway; there is much variation in the code and laws dealing with groundwater pollution; and suggested distances from landfill to water wells varied from 50 to 1000 feet. Based on the literature findings plus the result of the State survey, recommendations are offered to minimize groundwater pollution problems stemming from landfill operations. (Knapp-USGS)
W72-04654

PROPOSED BASE-LINE SAMPLING PROGRAM,
For primary bibliographic entry see Field 05A.
W72-04665

IDENTIFICATION OF GLOBALLY DISTRIBUTED WASTES IN THE MARINE ENVIRONMENT,
For primary bibliographic entry see Field 05A.
W72-04666

5C. Effects of Pollution

ECOLOGICAL EFFECTS OF A THERMAL POWER PLANT ON THE AQUATIC HABITAT OF A LARGE FRESH WATER LAKE IN THE UNITED STATES,
Detroit Edison Co., Mich.; and Michigan State Univ., East Lansing.
J. J. Roosen, and R. C. Ball.
Paper 2.1-47, 8th World Energy Conference, Bucharest, Romania, June-July, 1971. 19 p, 4 fig, 2 ref.

Descriptors: *Ecology, *Thermal pollution, *Thermal powerplants, Fish, *Environmental effects, Water pollution, Aquatic environment, Biology, Waterfowl, Electric utilities, Industrial plants, Sampling, Physical properties, Water quality, *Lakes, Investigations, Aquatic life.
Identifiers: *Lake Erie, Great Lakes.

The 5 Great Lakes provide a large supply of fresh water and vast water resources to North Central and Northeastern U S and Southern Canada. The Detroit Edison Co, in southeastern Michigan, uses these waters for a variety of purposes; the largest use is the economical condensation of steam from thermal plants providing a low-cost and reliable source of electric power. Recent expansion of electrical use in the area has resulted in the siting of a 3200-mw fossil-fueled plant on the Michigan shore of Lake Erie. The chemistry and biology of the aquatic environment of the lake receiving discharges from the large generating plant are described. The design basis and description of the 4-yr ecological program formulated by Michigan State University to determine the impact of the plant on the aquatic habitat are included. Information will be collected on: (1) basic plant producing groups--the periphyton, the phytoplankton and the macrophytes, (2) zooplankton, (3) bottom fauna, (4) fish, and (5) waterfowl. Physical and chemical studies are also described. Significance of physical, chemical, and biological changes are discussed from the standpoints of minimizing detrimental ecological changes and conserving the large fresh water resources available for multipurpose use. (USBR)
W72-04110

FERTILIZER NITROGEN: CONTRIBUTION TO NITRATE IN SURFACE WATER IN A CORN BELT WATERSHED,
Washington Univ., St. Louis, Mo. Center for the Biology of Natural Systems.
For primary bibliographic entry see Field 05B.
W72-04133

A METHOD FOR THE DETECTION AND QUANTITATIVE ESTIMATION OF SUBLETHAL POISONING IN LIVING FISH,
Uppsala Univ. (Sweden). Inst. of Zoophysiology.
P. E. Lindahl, and E. Schwanbom.
Oikos, Vol 22, No 2, p 210-214, 1971. 3 fig, 1 tab, 8 ref.

Descriptors: *Heavy metals, *Toxicity, Fish, Water pollution effects, Laboratory equipment, Bioassay, *Lethal limit.
Identifiers: *Mercury, Leuciscus rutilus, Roach, Methylmercuric hydroxide, Sweden, Salmo trutta.

For estimating the level of sublethal mercuric poisoning in fish populations, the fish are placed in a horizontal, transparent tube which rotates around its horizontal axis and includes a device that causes the water to rotate with the tube. When the speed of revolution is increased, a critical r.p.m. is reached at which the fish cannot compensate for the torque and are forced to rotate. In this study, fish were exposed to methylmercuric hydroxide which was shown to significantly reduce the critical r.p.m. This decrease in critical r.p.m. was found to be linearly correlated to the amount of mercury per unit wet weight of muscles. (Mortland-Battelle)
W72-04135

A MICROBIOTIC ECOASSAY FOR ENVIRONMENTAL POLLUTANTS,
Massachusetts Univ., Waltham. Dept. of Environmental Sciences.
H. B. Gunner, and R. A. Coler.
PB-206 691. Massachusetts, Water Resources Research Center, Amherst, Completion Report 72-5. 17 p, 4 tab, 6 ref. OWRR A-047-MASS (2).

Descriptors: *Pollutants, *Assessments, *Organophosphorous compounds, *Diazinon, *Trophic level, Aquatic microbiology, Methodology, Insecticides, Correlation analysis, Balance of nature, Computer models, Application methods, Soil microorganisms, Nematodes, Ecological distribution, Water pollution sources, Fish behavior.
Identifiers: *Bioassay system, Biological pollutants, Ecosystem response, Chemical stress, Duckweed (Lemna minor).

A technique is developed which offers both insights of field study and experimental control of the laboratory to measure at all trophic levels simultaneously the ecosystem response to biologically or chemically induced stress. Methods used by past investigators included model studies and studies of individual species as indices of environmental quality. Model studies fail to mirror dynamics in the natural habitat while studies of individual species provide only limited insight into population dynamics of the intact ecosystem. These methods make adaptation and extrapolation to field conditions extremely tendentious. This report describes observations of exogeneous chemical stress and the response of various aquatic plants and fish to various stresses. The initial stress tested relates to organophosphate insecticide, Diazinon, known for high selectivity for soil microorganisms. Though the results of this study are preliminary and fragmentary, statistical analysis indicates a potential for computer simulated ecoassay. The novel use of an entire biota as a bioassay system rather than the classical resort to 'universal indicator species' is significant. (Lang-USGS)
W72-04208

EFFECTS OF SECONDARY AND TERTIARY WASTEWATER EFFLUENTS ON ALGAL GROWTH IN A LAKE-RIVER SYSTEM,
Pacific Northwest Water Lab., Corvallis, Oreg.
W. E. Miller, and T. E. Maloney.
Journal Water Pollution Control Federation, Vol 43, No 12, December 1971, p 2361-2365. 4 fig, 2 tab, 2 ref.

Descriptors: *Waste water treatment, *Sewage effluents, Water pollution effects, Lakes, *Eutrophication, Phosphorus, Nitrogen, Tertiary treatment, Nutrient requirements.
Identifiers: *Algal assay.

The National Eutrophication Research Program of the Environmental Protection Agency is involved with several projects relating to the restoration of natural lakes. One of these lakes is Shagawa Lake in Minnesota. The primary flow into the lake is from the Burntside River which supplies nearly 80% of the inflow. The city of Ely discharged primary effluent into the lake from 1903 to 1954 and secondary effluent from 1954 on. Laboratory studies have been conducted to determine the effect of tertiary treatment on algal growth in Shagawa Lake water. The unicellular green alga, SELENASTRUM capricornutum, was used exclusively throughout these tests. River water was tested in parallel with the lake water to determine its ability to support algal blooms. The use of algal assays of this type offer a great deal of promise in evaluating the impact of various courses of action on lake eutrophication. These assays must be made on at least a seasonal basis to acquire sufficient data. Burntside River water seemed to be phosphorus deficient while the Shagawa Lake water was phosphorus and/or nitrogen deficient, depending on the time of year. It was determined that the installation of full-scale advanced treatment capable of high phosphorus removal would retard the eutrophication process and eventually assist in restoring Lake Shagawa. (Goessling-Texas)
W72-04219

TOXIC EFFECTS OF ODOROUS TRACE ORGANICS,
Missouri Univ., Rolla. Environmental Health Research Center.
J. W. Smith, and S. G. Grigoropoulos.
Journal of the American Water Works Association, Vol 60, No 8, p 969-979, August 1968. 2 fig, 5 tab, 12 ref.

Descriptors: *Water treatment, Public health, *Toxicity, *Organic compounds, *Bioassay, Pesticides, *Odor.
Identifiers: *Trace organics.

The batch-type long-term bioassay, necessary because of limited quantity of organics available, provided a workable procedure for the evaluation of the cumulative long-term effects of trace organics from subsurface and surface Missouri waters. The subsurface water trace organics were odorous; the spring water extracts had a much lower threshold odor concentration than the deep well extracts and different characteristic odor. The surface and subsurface trace organics were toxic to fish under both acute and long-term conditions. In vitro toxicity studies using tissue homogenates proved useful in establishing whether a material was toxic and helpful in determining the probable mode of action. The subsurface water organics appeared to clog the gills and physically block the transport of oxygen into fish, while the mode of action for the surface water organics was probably an internal disruption of respiratory enzyme activity. A static long-term bioassay procedure which can be used when quantity of test material is limited was developed and evaluated with both the trace organics and a commercially available pesticide. (Bean-AWWA)
W72-04243

PHARMACOLOGICAL TESTING OF BLUE--GREEN ALGAE FOR CONSTITUENTS HAVING THERAPEUTIC VALUE,
World Life Research Inst., Colton, Calif.
Bruce W. Halstead.
Available from SOD EP2.10:16010DOU06/70, $0.95 in microfiche. Environmental Protection Agency, Water Quality Office, Water Pollution Control Research Series, June 1970. 17 p, 1 tab, 9 ref. EPA Program 16010DOU06/70, 14-12-535.

Descriptors: *Cyanophyta, *Laboratory tests, Algal toxins, Human pathology.
Identifiers: *Therapeutic value, *Aphanizomenon flos-aquae, *Pharmacological tests, Antimicrobiotics, Escherichia coli, Beta streptococcus, Pseudomonas aeruginosa, Mycobacterium furtuitum, Staphylococcus aureus, Candida albicans.

The blue-green alga Aphanizomenon flos-aquae (Linnaeus) Ralfs, was collected during the peak of its primary bloom and prepared with acetone and ethanolic extracts for pharmalogical and microbiological testing. The fractions exhibited little acute overtsymptomatology and thus probably do not contain products that exert pharmacological effects similar to the type seen by drugs which ordinarily directly produce psychomatic, neurological, or cardiovascular effects. Generally the activity of the fractions resulted in depression of function, alertness, and appetite, and decreased body weight in rats, characteristic of an antimetabolite action common to many naturally occurring substances. There was low potency, no fractional localization of activity, no significant neurological, cardiovascular, or any outstanding biological activity. Antimicrobial tests performed on Escherichia coli, Beta streptococcus, Pseudomonas aeruginosa, Mycobacterium furtuitum, Staphylococcus aereus, and Candida albicans. No antimicrobial activity was observed, however the algae could be classified as 'toxic' if sufficient quantities are ingested. A sample was screened, tested, and evaluated for antitumor activity but was not found to have any significant antitumor activity. The tests failed to show evidence of pharmacological properties having commercial pharmaceutical potential. Further investigation as to the commercial potential of the phytochemical constituents of Aphanizomenon flos-aquae does not appear warranted. (Auen-Wisconsin)
W72-04259

ANNUAL REPORT OF ACTIVITIES DURING FISCAL YEAR 1971.
Maine Univ., Bangor. Water Resources Center.

Available from the National Technical Information Service as PB-206 431, $3.00 in paper copy, $0.95 in microfiche. Annual Report No 7, 1971. 18 p, 3 append. OWRR A-999-ME (7).

Descriptors: *Water resources, *Water users, *Planning, *Projects, Legal aspects, Bottom sediments, Geochemistry, Hydrology, Coniferous forests, Rivers, Lakes, Biochemical oxygen demand, Dissolved oxygen, Management, Livestock wastes, Water quality, Education, Eutrophication, Phosphates, Water pollution control, Chlorinated hydrocarbon pesticides, Model studies, Tubificids, Physicochemical properties, Gases, Political aspects, Attitudes, Environment.

The research program conducted under the auspices of the University of Maine's Water Resources Center to solve Maine's water problems are described. Twelve projects explored the following areas: Hydrologic relationships in a coniferous forest; An investigation of the causes, effects, and control of eutrophication in Maine lakes; Phosphate retention by lake sediments; Geochemical cycles involving flora, lake water, and bottom sediments; Legal aspects of water pollution control through implementation of the effluent charge concept; Effect of animal wastes applied to soils on surface and ground water systems; The effects of DDT and other

chlorinated hydrocarbons on the growth of euryhaline microalgae; Phase III--Study of a river system as a chemical reactor; Effects of burrowing tubificid worms on the exchange of phosphorus between lake sediments and overlying water; A study of the physico-chemical parameters affecting the removal of colloidal particles from water by porous media; Dissolved pollution product gases in natural waters; and Political and environmental attitudes of voters and public officials related to alternative levels of water quality and correlated alternative systems of management of the Penobscot River. The Center's researchers extend their findings to users in an active coordination, information, education, and training program. (Auen-Wisconsin)
W72-04261

PHOSPHATE NUTRIENT OCCURRENCE AND DISTRIBUTION IN GREAT LAKES SEDIMENTS,
Illinois Univ., Chicago. Soil Mechanics Lab.
Marshall L. Silver, and Charles A. Moore.
SM Publication No 12, 1971. 27 p, 7 fig, 5 tab, 55 ref. OWRR A-053-ILL (1).

Descriptors: *Phosphates, *Great lakes, *Sediments, *Nutrients, Eutrophication, Nitrogen, Littoral, Harbors, Spatial distribution, Algae, Tributaries, Cycling nutrients.
Identifiers: *Nutrient levels, Cuyahoga River (Ohio).

Published and unpublished sources are combined to provide insight into the source and fate of pollutants in the Great Lakes. Data are presented summarizing the quantity of phosphorus present in central lake waters and central lake sediments as well as phosphorus contents in sediments and waters of rivers and harbors tributary to the lakes, and nutrient contents in the Great Lakes margins. Available literature is summarized describing the effect of phosphorus on the growth rate of aquatic plants whose accelerated growth is responsible for eutrophication. An attempt is made to organize mechanisms contributing to the cycling of phosphorus and other nutrients important to Great Lakes studies. Generally, the minimum phosphorus content needed for algal growth is below 0.01 mg/l and may be less than 0.001 mg/l. Phosphorus levels in excess of 0.1 mg/l often cause accelerated growth of various phytoplankton and algae. Nitrogen contents greater than 0.1 mg/l are necessary for growth while concentrations greater than 1 mg/l lead to accelerated plant growth. (Auen-Wisconsin)
W72-04263

SPECIES DIVERSITY OF BENTHIC MACROINVERTEBRATES IN THREE MICHIGAN STREAMS,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
Jeffrey C. Gislason.
MS Thesis, 1971. 62 p, 8 fig, 10 tab, 24 ref, append. OWRR C-2205 (3386) (1) 14-31-0001-3153.

Descriptors: *Synecology, *Benthos, *Ecological distribution, *Biological communities, *Streams, Water pollution effects, Eutrophication, Dissolved oxygen, Water pollution sources, Aquatic plants, Test procedures, Municipal wastes, Industrial wastes, Agriculture, Fish hatcheries, Pesticides, Environmental gradient, Nutrients, Michigan.
Identifiers: *Species diversity, *Macroinvertebrates, Jordan River (Mich), AuSable River (Mich), Red Cedar River (Mich).

The effects of different levels of human perturbation (disturbance to the stream ecosystem by man, primarily artificial enrichment) on species diversity of benthic macroinvertebrates were compared in three Michigan streams examined periodically during an annual cycle. Two related formulas from information theory were used to calculate species diversity of benthic macroinvertebrates. The abundance of species and individuals in the aquatic macrophyte beds at the four study sites was related to the degree of perturbation at the sites. Numbers of species were highest under the lower levels of perturbation and lowest under the higher levels of perturbation. Abundance of individuals increased as the level of perturbation increased until the level of perturbation reached an extremely severe level at the Red Cedar site where the severe conditions may have limited abundance. Species diversity of benthic macroinvertebrates was inversely related to the degree of human perturbation. Information theory indices of species diversity appear to be sensitive to even slight changes in community structure caused by human perturbation. (Jones-Wisconsin)
W72-04264

DETERGENTS A STATUS REPORT.
National Industrial Pollution Control Council, Washington, D.C.

Available from the National Technical Information Service as COM-71-50084, $3.00 in paper copy, $0.95 in microfiche. Sub-Council Report March 1971. 16 p.

Descriptors: *Detergents, *Eutrophication, *Economic efficiency, *Public health, Water pollution, Hazards, Nutrients, Algae.
Identifiers: Nitrilotriacetic acid, Household detergents, Soap and detergent industry, NTA.

The use of the most promising substitute for phosphates in detergents, nitrilotriacetic acid (NTA) has been suspended pending further study at the request of the U S Surgeon General and the Environmental Protection Agency. The search for phosphate substitutes continues. Eutrophication is defined as simply the overabundance of a natural and necessary process--troublesome indeed when it occurs, but, by no stretch of the imagination, a form of water pollution. There is no evidence whatever that the removal of phosphates from detergents will stop accelerated eutrophication. Adequate technology exists to remove phosphorus from sewage by means of chemical treatment. For relatively modest costs, chemical sewage treatment permits the removal of phosphorus from all sources without the capital cost of secondary or tertiary sewage plants and it is highly flexible, in that it can be employed in only those localities where cultural eutrophication is a problem. (Jones-Wisconsin)
W72-04266

LIMNOLOGICAL CHARACTERISTICS OF NORTH AND CENTRAL FLORIDA LAKES,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
Earl E. Shannon, and Patrick L. Brezonik.
Research Report, 1971. 36 p, 9 fig, 3 tab, 31 ref. OWRR B-004-FLA (5). FWQA DON 16010.

Descriptors: *Limnology, *Florida, *Lakes, Ponds, Sampling, Thermal stratification, Hardness (Water), Color, Oligotrophy, Eutrophication, Algae, Cyanophyta, Phytoplankton, Lake morphometry, Geology, Limestone, Temperature, Depth, Chemical properties, Acidity, Alkalinity, Conductivity, Calcium, Scenedesmus, Water hyacinth, Light penetration, Oxygen, Silica, Aquatic plants.
Identifiers: Mesotrophic, Microcystis, Anabaena, Lyngbya.

An extensive survey of the physical, chemical, and biological characteristics of 55 north-central Florida lakes and ponds was made. Results of the one-year investigation, with particular reference to their typologic and trophic features are described. They are typically shallow, with mean depths ranging from 0.7 to 8.1 m and derived from solution of limestone formations which underly the Florida peninsula. Stable thermal stratification occurs in 13 lakes. They are typically soft water, low ionic strength waters. High organic color, derived primarily from pine litter, is common. Trophic conditions obtain from ultraoligotrophic to hypereutrophic. Multi-variate cluster analysis considering seven quantitative trophic indicators grouped the clear lakes into three readily interpretable groups (oligotrophic, mesotrophic, and eutrophic) and the colored lakes into five groups. Highest eutrophic conditions are associated with alkaline (hardwater) clear lakes, whereas the softwater clear lakes were all oligotrophic; color appears to dampen the range of trophic conditions. Algal blooms can occur almost continuously throughout the year in eutrophic lakes because of favorable growth conditions; the blue-green bloom-forming algae, Microcystis, Anabaena, and Lyngbya are the most dominant phytoplankton of eutrophic Florida lakes. (Jones-Wisconsin)
W72-04269

PRIMARY PRODUCTIVITY IN FIVE SALT VALLEY RESERVOIRS,
Nebraska Univ., Lincoln. Dept. of Zoology.
John L. Andersen.
MS Thesis, August 1971. 54 p, 12 fig, 5 tab, 22 ref. OWRR A-014-NEB (1).

Descriptors: *Primary productivity, *Reservoirs, *Nebraska, *Eutrophication, Plankton, Chlorophyll, Recreation, Runoff, Measurement, Test procedures, Photosynthesis, Seasonal, Light penetration, Light intensity, Dissolved solids, Phytoplankton, Algae, Nutrients.
Identifiers: *Salt Valley Reservoirs (Neb), Ultra plankton, C-14.

Five Salt Valley Reservoirs, located within a 20-mile radius of Lincoln, Nebraska, were constructed to provide flood protection but recreational facilities have also been extensively developed. These reservoirs depend upon runoff from agricultural lands as their source of water and are rich in nutrients. Morphometry and physical-chemical parameters are recorded. The in situ carbon-14 techniques were used for studying productivity. Absolute activity of the carbon-14 must be determined since there often exists a wide difference between the labeled and actual value of commercially prepared radioisotope solutions. The lakes are discussed individually and ranked according to productivity including productivity values, chlorophyll values, and the ultra plankton contribution, which ranged from 0 to 13.3% of the total productivity. Primary productivity occurring under the ice constitutes a large portion of the annual productivity and cannot be ignored. In comparing the productivity of the Salt Valley Lakes with other lakes around the world, it can be seen that the Salt Valley Lakes are quite eutrophic. If the rate of yearly productivity increases in these reservoirs (500-600 mg/year) continues, it may be a short time until these lakes are in the productivity range of sewage lagoons. (Jones-Wisconsin)
W72-04270

A STUDY OF THE LIMNETIC ZOOPLANKTON OF FIVE FLOOD CONTROL RESERVOIRS,
Nebraska Univ., Lincoln. Dept. of Zoology.
Glen R. Helzer.
MS Thesis, August 1971. 145 p, 33 fig, 12 tab, 80 ref, 5 append. OWRR A-014-NEB (2).

Descriptors: *Zooplankton, *Reservoirs, *Biological distribution, Crustaceans, Sampling, Seasonal, Nebraska, Copepods, Daphnia, Temperature, Food abundance, Life cycles, Standing crop, Productivity, Systematics, Lake morphometry, Chlorophyll, Herbivores, Morphometry, Trophic level.
Identifiers: Cladocera, Diaptomus, Bosmina, Salt Valley Reservoirs (Neb), Branched Oak Reservoir (Neb), Holmes Reservoir (Neb), Pawnee Reservoir (Neb), Wagontrain Reservoir (Neb), Stagecoach Reservoir (Neb), Haplopoda, Eucladocera, Limiting zones.

Cladocera and Copepoda are described and illustrated in a study of five Salt Valley watershed

flood control reservoirs in southeastern Nebraska. Observations were made from May 1968-January 1970 of four reservoirs in summer and one the year-round. The limnetic summer zooplankton communities consisted, on the average, of 3.2 cladoceran sp and 2.4 copepod sp. Congeneric occurrences of Diaptomus and Daphnia species were common. Means of maintaining reduced interspecific competition are discussed. Bosmina longirostris, a species characteristic of eutrophied waters, was found in the clear water reservoirs in which primary production was greatest. B coregoni, often associated with oligotrophism, was found to occur in the turbid, less-productive reservoirs. Seasonal cycles and abundance of each species of limnetic zooplankter from each of the five reservoirs are compared and discussed. Daphnia pulex was the dominant zooplankter in Pawnee and Branched Oak Reservoirs during the initial month of the study. It was replaced almost entirely by the smaller Daphnia galeata mendotae, a phenomenon directly associated with more intensive fish predation and indirectly with increasing eutrophication. Seasonal form change (cyclomorphosis) is analyzed in Daphnia galeata mendotae. Summer zooplankton standing crops were compared through time in each reservoir. (Jones-Wisconsin)
W72-04271

QUALITATIVE AND QUANTITATIVE ANALYSIS OF THE MACRO-BENTHIC FAUNA OF FIVE GREAT PLAINS RESERVOIRS,
Nebraska Univ., Lincoln. Dept. of Zoology.
Dennis C. Lessig.
MS Thesis, August 1971. 144 p, 34 fig, 13 tab, 70 ref, 6 append. OWRR A-014-NEB (3).

Descriptors: *Analysis, *Benthic fauna, *Reservoirs, *Great Plains, Biological communities, Eutrophication, Sampling, Sludge worms, Turbidity, Invertebrates, Nebraska, Standing crop, Productivity, Seasonal, Life history studies, Mayflies, Midges, Biomass, Chlorophyll, Mathematical studies, Temperature, Dissolved oxygen, Nematodes, Crustaceans, Oligochaetes, Mollusks, Diptera.
Identifiers: *Macro-benthos, Species diversity, Species composition, Salt Valley Reservoir (Neb), Wagontrain Reservoir (Neb), Holmes Reservoir (Neb), Pawnee Reservoir (Neb), Branched Oak Reservoir (Neb), Stagecoach Reservoir (Neb).

The benthic invertebrates of eastern Nebraska are reported for the first time. Five, shallow, eutrophic reservoirs near Lincoln were sampled from June 1968 to September 1970. Qualitatively all five reservoirs had similar faunas. Drastic changes in the benthos occurred during the initial stages of filling of Branched Oak Reservoir due to increasing water depths and changing substrates. Standing crops in different reservoirs were compared and with other eutrophic situations. Seasonal distributions, periods of emergence, peaks and lows in the population, and generations were examined for those species which were significant members of the benthos and where data permitted. The burrowing mayfly (Hexagenia limbata), the phantom midge (Chaoborus punctipennis), the chironomids (Glyptotendipes polytomus, Tendipes tentans, Procladius culiciformis, Coelotanypus concinnus, Harnischia, and Tanytarsus) were among the main contributors to the benthos. Species diversity values were calculated and used to compare the stations within the reservoirs, and reservoir with reservoir. The production of benthos in the reservoirs was considered by comparing benthic biomass to standing crop of chlorophyll a. The species diversity values served as good indicators of eutrophication in the study reservoirs, the lower their values, the greater the degree of eutrophication. (Jones-Wisconsin)
W72-04272

PHYTOCHEMICAL, PHARMACOLOGICAL AND ANTIMICROBIAL SCREENING OF MINNESOTAN AQUATIC PLANTS,
Minnesota Univ., Minneapolis.
Kwei Lee Su.
PhD Thesis, June 1971. 158 p, 13 fig, 23 tab, 342 ref. OWRR A-025-MINN (1).

Descriptors: *Aquatic plants, *Algae, *Public health, Analytical techniques, Toxicity, Chemical properties, Minnesota, Lipids, Human pathology, Diseases.
Identifiers: Antimicrobiotics, Pharmacological properties, Phytochemical screenings, Nymphaea tuberosa, Nuphar variegatum, Nuphar japonicum, Nuphar luten, Anticancer potential, Anticoagulant potential, Sparganium fluctuans, Antineoplastic activity, Alkaloids, Flavonoids, Steroids, Tannins, Saponins.

Seventeen monocots, 4 dicots, and 1 alga, collected from Minnesota lakes were extracted with skellysolve F, chloroform, 80% ethanol, and acidic and basic water. As revealed by thin-layer chromatography and other analyses, many plants contain alkaloids, flavonoles, flavonones, beta-sitosterol, lipids, tannins, and saponins. The toxicity, including lethal dose, median test, and antineoplastic activity in viro were determined using Swiss Webster mice and Syrian hamsters. Screening was performed on human epidermoid carcinoma and lymphoid leukemia. Antimicrobial effects of extracts were studied on both animal and plant pathogenes by the disc diffusion method. Some extracts were effective against Staphylococcus aureus, Mycobacterium smegmatis, and Candida albicans. Recommendations for additional studies include identification of certain alkaloids, anticancer potential against amelanoma malignancy, anticoagulant effects of several aquatic plants, and inhibition of Candida albicans. (Wilde-Wisconsin)
W72-04275

ONONDAGA LAKE STUDY.
Onondaga County, Syracuse, N.Y.

SOD No SN 5501-0099 $4.50, $0.95 in microfiche, PB-206 472. Environmental Protection Agency, Water Quality Office, Water Pollution Control Research Series, April 1971. 487 p, 101 fig, 70 tab, 139 ref, append A, B, C, D, E. EPA Project 11060 FAE 4/71.

Descriptors: *Lakes, *Trophic level, *Chemical properties, *Geochemistry, *Physical properties, *Biological properties, Mixing, Sediments, Plankton, Fish, Limnology, Dissolved oxygen, Sanitary engineering, Hydrography, Water pollution control, Water pollution sources, Thermal pollution, Industrial wastes, Data collections, New York.
Identifiers: *Onondaga Lake (NY), Engineering evaluation, Sewage treatment plant impact, Mercury.

This study was conducted to appraise the trophic status of the saline Onondaga Lake, New York, and to estimate the effects of the proposed waste treatment plant. The determined parameters included circulation patterns, distribution of chemical constituents, and the biotic contents of the lake. Mineral-water equilibria showed an uninterrupted and a widely distributed formation of phosphate-bearing minerals. The predominant component of lake sediments is calcium. The salinity of lake water did not preclude occurrence of a wide variety of phytoplankton, zooplankton, and fish. Proposed waste treatments should significantly increase the supply of dissolved oxygen and lower the phosphorus concentration. The recommended monitoring program should indicate the effectiveness of the future ameliorations. (Wilde-Wisconsin)
W72-04277

WATER QUALITY VARIATIONS IN THE BROADKILL RIVER ESTUARY,
Delaware Univ., Newark.
Wallace deWitt, III.
PhD Thesis, June 1971. 127 p, 15 fig, 21 tab, 51 ref, append. OWRR A-006-DEL (2).

Descriptors: *Water quality, *Delaware, *Estuaries, *Water pollution, Rivers, Sewage, Chlorophyll, Dissolved oxygen, Tides, Fluctuation, Water pollution effects, Salinity, Saline-freshwater interfaces, Degradation (Decomposition), Anaerobic conditions, Phosphorus, Nitrogen compounds, Seasonal, Cycling nutrients, Iron, Sulfur.
Identifiers: Broadkill River (Dela).

The maximum average concentrations of ammonia, inorganic phosphorus, and chlorophyll in the estuarine system were recorded in the summer, whereas those of dissolved oxygen and nitrates in winter. The highest average contents of organic phosphorus were determined in autumn. The maximum concentrations of nutrients and chlorophyll were found in the tidal fresh water downstream from the sewage outfall. During late spring and early fall, this segment exhibited anoxic conditions due to an increased bacterial decomposition or organic matter. The deficiency of oxygen induced a drastic reduction in the nitrates and nitrites content. The phosphorus cycle was influenced by bacterial activity and the interaction with iron and sulfur. During winter, turbulence and a low BOD alleviated anoxic conditions. The observed variations in the estuarine sections appear to reflect the cycling of tidal fresh water. (Wilde-Wisconsin)
W72-04278

WORKSHOP-CONFERENCE ON RECLAMATION OF MAINE'S DYING LAKES.
Maine Univ., Bangor.

Available from the National Technical Information Service as PB-206 432, $3.00 in paper copy, $0.95 in microfiche. University of Maine at Orono, Maine, June 1971. 113 p, 4 fig, 1 map, 6 photo, 39 ref, 2 append. OWRR A-999-ME (8).

Descriptors: *Maine, *Eutrophication, *Water quality control, *Non-structural alternatives, Aging (Biological), Aquatic algae, Aquatic productivity, Fish, Fishkill, Limnology, Nutrients, Oxygen, Oxygen requirements, Oxygen sag, Waste assimilative capacity, Water properties, Water pollution, Water pollution sources, Water pollution effects, Water pollution control, Water pollution treatment, Water quality, Water quality control, Land use, Land tenure, Land development, Land management.

Methods of correcting and preventing eutrophic lakes in Maine are comprehensively discussed in this report of a conference conducted at the University of Maine. Eutrophication was the first conference topic considered; the eutrophication process, effects, and remedies were discussed. Particular emphasis was placed upon lake fertilization, cultural eutrophication and its causes, land drainage, and wastewater discharge. Generally, the topics were examined by means of panel discussions which solicited questions from the audience. Various techniques for correcting eutrophication to achieve inland lake renewal were discussed; the address described the problem, reclamation projects, and destratification methods. Land use and planning considerations in controlling eutrophication were described, with emphasis upon an integrated zoning, planned unit development, and sanitation program to prevent eutrophication. A highly technical address concerning lake flushing rates for water quality control was also presented. Methods of sampling lake water quality were discussed, along with the function of the Maine Inland Fish and Game Department in water quality control. The conclusion addresses the role of law in maintaining lake water quality. (See also W72-04280 thru W72-04285) (Hart-Florida)
W72-04279

EUTROPHICATION - THE PROBLEM - DETECTION - EXTENT,
Maine Univ., Orono. Water Resources Research Center.

Millard W. Hall.
Proceedings, Workshop--Conference on reclamation of Maine's dying lakes, held at University of Maine, Bangor, March 24-25, 1971. p 5-13.

Descriptors: *Eutrophication, *Lakes, *Maine, Recreation, Water supply, Water pollution effects, Water pollution sources, Algae, Nutrients.
Identifiers: *Lake Annabessacook (Me), *Kennebec River (Me), Cultural eutrophication.

Natural and cultural eutrophication are defined and stress is placed on the limited possibilities available to man in his efforts to reduce the accumulation of nutrients in water basins and to liquidate the resulting biological 'imbalance.' Particular emphasis is placed on the futility of algal control by copper sulfate and other chemicals. Diversion of wastewaters may prevent the cultural eutrophication of certain lakes, e.g., Lake Annabessacook, but only at the cost of polluting a river. The use of inocula of parasitic viruses may achieve control of blue-green algae. (See also W72-04279) (Wilde-Wisconsin)
W72-04280

INLAND LAKE RENEWAL: CORRECTION TECHNIQUES, DEMONSTRATION METHODS, SUCCESSES AND FAILURES,
Maine Univ., Orono. Water Resources Research Center.
Stephen Born.
Proceedings, Workshop--Conference on reclamation of Maine's dying lakes, held at University of Maine, Bangor, March 24-25, 1971. p 19-24.

Descriptors: *Eutrophication, *Nutrients, *Model studies, Lakes, Algicides, Lake shores, Sedimentation, Phosphorus, Water pollution control, Sediments, Diversion, Land use, Dredging, Bottom sediments, Biocontrol, Maine, Wisconsin.
Identifiers: Wisconsin Demonstration Project, Horseshoe Lake (Wis), Lake reclamation.

The Wisconsin Inland Lake Renewal Demonstration Project including amelioration and protection of lakes is described. Among the reclamation measures, the following are most common: diversion of wastewaters, reduction of phosphorus supply by additions of aluminum, iron, or lime, and land use control through zoning, sanitary codes, and subdivision ordinances. Other methods of limiting lake fertility include dredging removal, or exposure and oxidation of lake sediments, harvesting of fish and vegetation, destratification by artificial aeration, and the use of bottom sealants. Maintenance of lakes is largely dependent on the introduction of predatory or parasitic organisms, such as insects, fish, and viruses, and an occasional limited use of eradicants--sodium arsenate and 2,4-D. (See also W72-04279) (Wilde-Wisconsin)
W72-04281

PRESERVING LAKES BY PROTECTING THEIR SHORELANDS,
Maine Univ., Orono. Water Resources Research Center.
Douglas A. Yanggen.
Proceedings, Workshop--Conference on reclamation of Maine's dying lakes held at University of Maine, Bangor, March 24-25, 1971, p 27-49. 16 ref.

Descriptors: *Eutrophication, *Lake shores, *Water pollution control, *Wisconsin, *Legislation, Maine, Zoning, Land use, Flood plain zoning, Environmental sanitation, Septic tanks, Minnesota, Watershed management.
Identifiers: *Shoreland protection, *Fox River (Wis).

Laws, legislative provisions, and ordinances applying to Wisconsin lake and stream shorelands to implement water pollution control are described. The comprehensive plan for the Fox River (Wisconsin) and the Minnesota shoreland protection program are reviewed. (See also W72-04279) (Wilde-Wisconsin)
W72-04282

SAMPLING LAKE WATER QUALITY,
Maine Univ., Orono. Water Resources Research Center.
Ronald B. Davis.
Proceedings, Workshop--Conference on reclamation of Maine's dying lakes held at University of Maine, Bangor, March 24-25, 1971, p 67-84.

Descriptors: *Sampling, *Eutrophication, *Lakes, *Water quality, Maine, Monitoring.
Identifiers: Volunteer lake observers.

Sampling of lake characteristics which relate to eutrophication are discussed and appropriate parameters to be evaluated in determining the trophic status of lakes include geographical, chemical, and biological. Stress is placed on the importance of profile sampling of certain factors and the time of sampling summer stratifying and non-stratifying lakes. A proposal is made to organize a network of volunteer lake observers. (See also W72-04279) (Wilde-Wisconsin)
W72-04284

THE LAW AND THE LAKES,
Maine Univ., Orono. Water Resources Research Center.
Orlando E. Delogu.
Proceedings, Workshop--Conference on reclamation of Maine's dying lakes, held at University of Maine, Bangor, March 24-25, 1971. p 103-108.

Descriptors: *Lakes, *Legal aspects, *Social aspects, *Public rights, Maine, Social needs, Social adjustment, Legislation, Zoning, Lake shores.
Identifiers: Shore development.

A sensible balance between development and preservation of natural resources requires rejection of the idea that landownership is something absolute and inviolate. Legislation has been offered in the past, and can be offered again to allow the State to zone, say a 1000 ft belt back from the frontage of lakes, streams, or the ocean. Because frontage is the scarce resource, the future development may have to be of cluster patterns with common holding of the lakeshore. (See also W72-04279) (Wilde-Wisconsin)
W72-04285

LONG TERM EFFECTS OF PESTICIDES ON STREAM INVERTEBRATES,
Michigan Univ., Ann Arbor. Dept. of Environmental Health; and Michigan Univ., Ann Arbor. Dept. of Industrial Health.
M. E. Bender, and P. Eisele.
Available from the National Technical Information Service as PB-206 692, $3.00 in paper copy, $0.95 in microfiche. Completion Report, December 1971. 28 p, 6 fig, 7 tab, 5 ref. OWRR A-029-MICH (1).

Descriptors: *Toxicity, *Pesticides toxicity, Aquatic environment, *Insecticides, Bioassay, Michigan, *Mayflies, Degradation (Decomposition), *Lethal limit, *Stoneflies, Hydrolysis.
Identifiers: *Midges, *Methoxychlor, Ann Arbor (Mich).

THE HALF-LIFE OF THE INSECTICIDE METHOXYCHLOR IN VARIOUS AQUATIC ENVIRONMENTS WAS DETERMINED. Acute bioassays were conducted on Taeniopteryx nivalis, Chironomus tentans and Stenonema candidum. The breakdown of methoxychlor was studied in water from three sources: distilled water at pH 7 and pH 9; water from the city of Ann Arbor; and water from Kock Warner Creek at the Saline Fisheries Research Station, utilizing the experimental streams. The breakdown of methoxychlor in water was dependent upon microbial degradation. Half-life under conditions where hydrolysis was the primary mode of decomposition was calculated to be approximately 200 days, whereas in experiments where flora and fauna were present, ranged from 2-7 days.
W72-04288

ADENOSINE TRIPHOSPHATE IN LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
C. C.Lee.
Wisconsin Water Resources Center, Madison, Ph.D. Thesis, 1971. 98 p, 5 fig, 14 tab, 111 ref. OWRR B-022-WIS (7).

Descriptors: *Soil bacteria, *Lake soils, *Phosphorus, *Eutrophication, Lakes, Aquatic algae, Bacteria, Biochemistry, Wisconsin.
Identifiers: *Adenosine triphosphate, *Microbial biomass, *Growth stage, *Determination, *Origin, *Significance, *Extraction, Luciferin-luciferase method, Sediment-water interactions, Bioluminescence, Selenastrum capriconutum, Aerobacter aerogenes.

A modification of the luciferin-luciferase bioluminescence technique was developed for determining adenosine triphosphate (ATP) in sediments. ATP recovery ranged from 20 to 85%, was a characteristic, reproducible property of a given sediment, but was not related consistently to any other sediment property. Generally, the detection limits of the method were about 0.05 microgram ATP/g oven dry sediment. The ATP contents of nine sediment samples obtained from different lakes in Wisconsin ranged from 0.34 to 9.5 microgram ATP/g sediment. The ATP content of Selenastrum capriconutum was evaluated in relation to growth stage, substrate P status, and the applicability of ATP as an index of living algal cell material in bioassay systems. Generally, the ATP content per viable cell in PAAP medium was maintained relatively constant within a 4 to 6.5 x 10 to the minus 8th power microgram/cell range over a 32-day incubation period. Viable cells comprised only 40 to 50% of the total cells from 8 to 32 days. ATP per living biomass was 3 microgram/mg in PAAP medium. In P-deficient PAAP medium the ATP content of S. capriconutum declined to about 2 x 10 to the minus 8th power microgram/viable cell and 1.5 microgram/mg living biomass. Nevertheless, precise conversion of ATP to living algal cell material necessitates consideration of the effect of nutrient, particularly P, deficiencies on the algal ATP pool.
W72-04292

THE LAKE NOQUEBAY PROJECT: REPORT ON THE FIRST PHASE IN A MULTI-DISCIPLINARY STUDY OF A RECREATIONAL LAKE,
Wisconsin Univ., Green Bay.
For primary bibliographic entry see Field 06B.
W72-04293

DISTRIBUTIONAL ECOLOGY AND BEHAVIORAL THERMOREGULATION OF FISHES IN RELATION TO HEATED EFFLUENT FROM A STEAM-ELECTRIC POWER PLANT (LAKE MONONA, WISCONSIN),
Wisconsin Univ., Madison. Dept. of Zoology.
W. H. Neill.
Ph.D. Thesis, 1971. Wisconsin Water Resources Center, Madison, 216 p, 50 fig, 5 tab, 63 ref. OWRR B-028-WIS (1).

Descriptors: *Electric powerplants, *Outlets, *Lake, *Seasonal, *Fish, Water temperature, Zooplankton, Growth rates, Wisconsin, *Fish behavior, *Thermal pollution, Perches, Sculpins, Bass, Bullheads, Carp.
Identifiers: *Fish food, *Temperature preference, Lake Monona, Dane County (Wis), Perca flavescens, Cottus bairdi, Morone mississippiensis, Icalurus melas, Lepisosteus osseus, Cyprinus carpio.

Cooling water for a 220-megawatt power plant is pumped from 5 m beneath Lake Monona's surface, heated about 10 C, and discharged into the littoral zone. Maximum temperatures in the effluent-outfall area approach 35 C in summer, and 14 C in winter; unheated parts of the littoral zone rarely exceed 29 C. To assess the distributional responses of fish to the operation of the power plant, the outfall area and two reference areas

were electro-fished thirty times over a one-year period. Some fishes found in the reference areas avoided the outfall area, whereas other fishes were at higher concentration in the outfall area relative to the reference sites. The tendency for a species-size class to concentrate in or avoid the outfall area generally did not reverse from season to season or from day to night. Size-dependent movements of the fish tended to obscure the difference in growth rate of young fishes between study areas. Integrated laboratory studies on six species and field results suggest that fishes were distributed within the outfall area according to their ditferent temperature preferenda. Also, thermoregulatory behavior was overridden by feeding behavior even though zooplankton food was more abundant in the outfall area.
W72-04295

MATHEMATICAL MODEL TO COMPUTE REAERATION COEFFICIENTS FOR THE CONNECTICUT RIVER,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 05B.
W72-04374

A PRELIMINARY NOTE ON THE RELATIONSHIPS BETWEEN FORAMINIFERS AND POLLUTION IN TWO PUERTO RICAN BAYS,
Puerto Rico Univ. Mayaguez. Dept. of Geology.
For primary bibliographic entry see Field 05B.
W72-04386

CAN BOD CONTRIBUTE TO ALGAL MASS,
Washington State Univ., Pullman.
Ning-Hsi Tang, and Surinder K. Bhagat.
Water and Sewage Works, Vol 118, No 12, p 396-401, December 1971. 9 fig, 3 tab, 4 ref.

Descriptors: *Algae, *Biochemical oxygen demand, *Eutrophication, Phosphorous, Nitrogen, Chemical oxygen demand, Laboratory tests, Alkalinity, Carbonates, Bicarbonates, Carbon dioxide, Hydrogen ion concentration, Water quality control, Waste water treatment, Chlorophyta, Growth rates.
Identifiers: *Organic carbon, *Algal mass, Algal growth.

The effect of organic carbon on the growth of algae was demonstrated using glucose as a carbon source and COD as a measure of carbon present. Algae derive carbon from three sources, CO2 from the atmosphere, from carbonates and bicarbonates, and from organic material in the water. On a semicontinuous flow basis, once the algal-bacterial symbiosis was established, more algae grew in the flasks with organic carbon than grew in the flasks without organic carbon, even though all flasks were fed with equal, adequate amounts of N and P. Results indicate that the amount of excessive algal growth in an aquatic system will be about the same as the amount of influent BOD for a given wastewater influent BOD of less than 50 mg/l. For an influent wastewater BOD in excess of 50 mg/l the amount of excessive algal growth will be somewhat less than the incoming BOD. A graph was constructed to serve as a guide for predicting the amount of excessive algal growth for a given effluent BOD. (Lowry-Texas)
W72-04431

EVALUATION OF ALGAL ASSAY PROCEDURES--PAAP BATCH TEST,
California Univ., Irvine. School of Biological Sciences; and California Univ., Irvine. School of Engineering.
Steven Murray, Jan Scherfig, and Peter S. Dixon.
Journal Water Pollution Control Federation, Vol 43, No 10, p 1991-2003, October 1971. 4 fig, 13 tab, 3 ref.

Descriptors: *Bioassay, *Laboratory tests, Research and development, Trace elements, Algae, Nutrients, Light intensity, Hydrogen ion concentration, Carbon dioxide, Aeration, Mixing, *Eutrophication, *Analytical techniques, *Algal control.
Identifiers: Selenastrum capricornutum.

Preliminary investigations have demonstrated four important difficulties involved in the Provisional Algal Assay Procedure (PAAP) batch test. The four difficulties were: (1) the effects of medium preparation on the final composition of the medium; (2) pH changes during the test period in relation to carbon dioxide availability; (3) the method of gas addition in the batch test units; and (4) the effects of light intensity on algal growth. Because of these limitations, certain modifications to the standardized procedures were developed. A new culture media preparation which eliminates the precipitation of essential trace elements was developed and provides a reliable reference medium for algal assay work. The addition of CO2 -enriched air reduced the growth-limiting effects of CO2 and stabilizes the pH at 7.5 to 8.0. Aeration was shown to be more effective than ventilation for CO2 addition and gaseous as a result of bicarbonate utilization. Light intensities of 500 ft-c reduced growth rates of Selenastrum capricornutum in bottle test experimentation compared with 350 ft-c. (Lowry-Texas)
W72-04433

DETERGENTS IN WATER - A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.
For primary bibliographic entry see Field 05B.
W72-04438

MERCURY IN WATER-A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.
For primary bibliographic entry see Field 05B.
W72-04440

TERRESTRIAL AND FRESHWATER RADIOECOLOGY. A SELECTED BIBLIOGRAPHY,
Division of Radiation Protection Standards (AEC), Washington, D.C.
Alfred W. Klement, Jr., and Vincent Schultz.
Available from National Technical Information Service, Springfield, Va. 22151 as TID-3910 (Suppl. 7), $3.00 in paper copy, $0.95 in microfiche. TID-3910 (Suppl. 7), October 1971. 219 p.

Descriptors: *Bibliographies, *Radioecology, *Terrestrial habitats, *Fresh water, Brackish water, Radioactivity effects, Radioactivity techniques, Radioisotopes, Tracers, Tracking techniques, Wildlife.

This seventh supplement to the bibliography issued in March 1962 lists 2443 references and 36 bibliographies, in alphabetical order by the first author. There is no subject index. An attempt was made to reference publications related to wild species of plants and animals with respect to radiation effects or metabolic studies involving radionuclides. Studies of laboratory or domestic organisms have not in general been included unless such studies are ecological in nature, e.g., on population growth or synergistic. Studies of brackish water and brackish water organisms are included. Environmental monitoring is included only when natural waters and wild animals or plants are involved. (Bopp-ORNL)
W72-04452

RADIOACTIVITY TRANSPORT IN WATER. CONTINUOUS RELEASE OF RADIONUCLIDES IN A SMALL SCALE ECOSYSTEM,
Texas Univ., Austin. Center for Research in Water Resources.
Earnest F. Gloyna, Yousef A. Yousef, and Thomas J. Padden.
Technical Report-21, CRWR-75, EHE-71-1, ORO-21, September 1971. 66 p, 29 fig, 11 tab, 25 ref. AEC Contract AT (11-1)-490.

Descriptors: *Strontium radioisotopes, *Absorption, *Bottom sediments, *Rooted aquatic plants, Phytoplankton, Simulation, Model studies, Rivers, Radioactivity effects, Water pollution effects, Path of pollutants, Nuclear wastes, Mathematical models, Forecasting, Photosynthetic oxygen.
Identifiers: Cesium radioisotopes, Radionuclide uptake.

Radionuclide uptake by rooted aquatic plants, suspended phytoplankton, and bottom sediment was studied in a model river system for which radionuclide concentrations in water were below the guidelines. Rooted plants reached a quasi-equilibrium activity in 36 hours as compared to 30 days for bottom sediments. Suspended phytoplankton concentrations averaging about 20 mg/liter increased the transfer rate to bed sediments about 25%. The ratio of the radioactivity per g (dry weight) to that per ml water at quasi-equilibrium for rooted plants averaged 600 for Sr-85 and 400 for Cs-134. The ratio for phytoplankton was 200-700 for Sr-85 and 4,000-13,000 for Cs-134. Uptake of Cs-134 (but not of Sr-85) by phytoplankton was linearly related to the rate of photosynthetic oxygen production. The ratio of radioactivity per sq cm of sediment to that per ml of water was 70-90 for Sr-85 and 250-300 for Cs-134. (Bopp-ORNL)
W72-04454

INTERACTIONS OF DISSOLVED AND PARTICULATE NITROGEN IN LAKE METABOLISM,
Michigan State Univ., East Lansing.
Bruce A. Manny.
Available from the National Technical Information Service, Springfield, Va. 22151 as COO-1599-41, $3.00 in paper copy, $0.95 in microfiche. Report COO-1599-41, 1971. 202 p. AEC Contract AT (11-1)-1599.

Descriptors: *Eutrophication, *Lakes, *Michigan, Hypolimnion, Nannoplankton, Phytoplankton, Zooplankton, Nitrates, Nitrites, Ammonia, Reforestation, Bicarbonates, Water pollution effects.

Nannoplankton and nitrogenous, chemical, and biological parameters were measured in two Michigan lakes representing extremes of productivity. The lower rate of eutrophication of Lawrence Lake than of Wintergreen Lake probably results from a lower entrance rate of organic carbon and nitrogen and from a lower hypolimnetic temperature. Productivity in Lawrence Lake appears to be controlled from within by its bicarbonate system while that in Wintergreen Lake appears to be controlled by external seasonal changes in light and material entry. (Bopp-ORNL)
W72-04458

FALLOUT RADIONUCLIDES IN PACIFIC OCEAN TUNA,
Washington Univ., Seattle. Lab. of Radiation Ecology.
Edward E. Held.
Available from the National Technical Information Service, Springfield, Va. 22151 as NVO-269-13, $3.00 in paper copy, $0.95 in microfiche. Report NVO-269-13, May 10, 1971. 16 p.

Descriptors: *Food chains, *Radioactivity effects, *Commercial fish, *Pacific Ocean, Fallout, Water pollution effects, Nuclear explosions, Cobalt radioisotopes, Radioactivity techniques, Analytical techniques, Radioisotopes, Absorption, On-site data collections.
Identifiers: Iron radioisotopes, Cesium radioisotopes.

Fe-55 is the most abundant fallout radionuclide in many marine organisms. Tuna obtained in 1968-9 from a Japanese fishery and from the vicinity of Bikini Atoll were analyzed for Fe-55, stable Fe, Cs-137, and Co-60. Fe-55 in the dark muscle and in the liver of a single fish was about the same and was about 10-fold greater than in light muscle. The results for the dark muscle showed a wide range (Fe-55, 3.3-1600 pCi/g dry weight; stable Fe, 49-500 ppm; specific activity, 0.02-8.6 nCi Fe-55/mg Fe). There was no correlation of Fe-55 with species, fish size, or date of catch. The Fe-55 of most fish caught at all locations was in the low range; however the average was higher in fish north of the equator. Cs-137 averaged nearly the same in light and dark muscle (0.15 pCi/g dry weight). Co-60 was found only in the dark muscle and liver tissues of fish caught off Bikini Atoll (0.08-5.0 pCi/g dry weight). (Bopp-ORNL)
W72-04460

ECOLOGICAL ASPECTS OF PLUTONIUM DISSEMINATION IN AQUATIC ENVIRONMENTS; WHAT HAS PU DATA TO TELL US ABOUT OTHER TRANSURANICS,
Woods Hole Oceanographic Institution, Mass.
Victor E. Noshkin.
Available from the National Technical Information Service, Springfield, Va. 22151 as NYO-2174-132, $3.00 in paper copy, $0.95 in microfiche. Report NYO-2174-132, 1971. 31 p, 2 fig, 8 tab, 40 ref. AEC Contract AT (30-1)-2174.

Descriptors: *Radioactivity effects, *Fallout, *Food chains, *Aquatic life, Radioisotopes, Absorption, Nuclear wastes, Water pollution effects, Mollusks, Marine plants, Marine algae, Public health, Estuarine environment, On-site investigations, Reviews.
Identifiers: Plutonium.

This review indicates that fallout plutonium contributes more than strontium or cesium to the artificial radiation exposure of many marine species. Organisms at higher trophic levels and those which feed on sediments have more plutonium. Bone and liver have much more than muscle tissue. As use of nuclear power increases, such food items as anchovies, sardines, canned salmon, etc. which are consumed whole, and fish protein concentrates will represent important transfer vectors for plutonium. The relatively uniform plutonium uptake by the mussel (concentration factor of 200-500) suggests use as a biological indicator. The mussel indicates the plutonium more recently introduced into the water in suspension rather than that present in sediments. (Bopp-ORNL)
W72-04461

THE RECENT WASTE MANAGEMENT PROGRAMME IN JAPAN AND THE STUDIES OF THE BEHAVIOR OF RADIONUCLIDES IN THE MARINE ENVIRONMENT FOR HAZARD EVALUATION OF SEA WASTE DISPOSAL,
National Inst. of Radiological Sciences, Tokyo (Japan).
T. Kuyangi, Y. Ohmomo, M. Ishikawa, S. Hirano, and M. Saiki.
Available from the National Technical Information Service, Springfield, Va. 22151, as A/CONF.49/P/850, $3.00 in paper copy, $0.95 in microfiche. Report A/CONF.49/P/850, May 1971. Fourth United Nations International Conference on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6-16 September 1971.

Descriptors: *Nuclear wastes, *Japan, *Nuclear powerplants, *Fuels, *Water pollution, *Water pollution sources, Radioactive waste disposal, Marine animals, Marine fish, Radioisotopes, Radioactivity effects, Food chains, Population, Public health, Sorption, Absorption, Marine plants, Aquatic life, Regulations.
Identifiers: Radionuclide uptake, Radionuclide transfer, Concentration, Reprocessed fuel waste, Critical nuclide pathway, Safety evaluation.

In assessing the consequences of disposal of radioactive waste into the sea, the primary aim is to establish the resultant radiation dose or exposure to man and marine organisms, since the dose or exposure is the quantity most directly related to possible biological hazards. It is necessary to establish the relationship between the rate of introduction of the radioactivity material and the radiation dose in order to arrive at an estimate of the limiting environmental capacity for the specified radionuclides on the basis of the standards implied by the ICRP dose limits for members of the public. To clarify various factors necessary for the hazard evaluation associated with the discharge of radioactive wastes into the sea, a number of investigations have been conducted and are reported. (Houser-ORNL)
W72-04462

INFLUENCE OF THE PHYSICO-CHEMICAL FORMS OF RADIONUCLIDES AND STABLE TRACE ELEMENTS IN SEAWATER IN RELATION TO UPTAKE BY THE MARINE BIOSPHERE,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
D. E. Robertson.
Available from the National Technical Information Service, Springfield, Va. 22151, as BNWL-SA-4048, $3.00 in paper copy, $0.95 in microfiche. BNWL-SA-4048, September 8, 1971. 60 p, 105 ref. AEC Contract no. AT (45-1)-1830.

Descriptors: *Radioactivity effects, *Nuclear wastes, *Fallout, *Oceans, Water pollution effects, Food chaines, Public health, Estuarine environment, Zinc radioisotopes, Physicochemical properties, Fish, Marine plants, Marine algae, Hydrolysis, Chelation, Sediments, Settling velocity, Radioisotopes, Absorption, Reviews.
Identifiers: Plutonium radioisotopes, Ruthenium radioisotopes, Iron radioisotopes.

This review presents examples of dissimilar biological uptake between important artificial radionuclides (Fe-55, Zn-65, and Ru-106) and their stable isotopes in the marine environment. Although definitive work is needed, there is evidence that Zn, Fe, and Cu are present as soluble metal chelates. Ru, Fe, and Mn hydrolyze to form polymeric species. Most Pu is in particulate form. The relatively high uptake of Pu by seaweeds and certain crustaceans appears to be a surface absorption process. The maximum permissible concentration of Pu in seawater is about 6 x 0.01 microCi/ml, based upon a single intake of 200 gms of fish per individual. (Bopp-ORNL)
W72-04463

COLUMBIA RIVER STUDIES ANNUAL PROGRESS REPORT (1970-1971),
Washington Univ., Seattle. Lab. of Radiation Ecology.
Allyn H. Seymour.
Available from the National Technical Information Service, Springfield, Va. 22151, as RLO 2225-T-1-8, $3.00 in paper copy, $0.95 in microfiche. Report RLO 2225-T-1-8, 1971. 12 p, 1 fig, 4 tab. AEC Contract no. AT (45-1)-2225-T1.

Descriptors: *Aquatic life, *Radioisotopes, *Columbia River, Absorption, Monitoring, Aquaria, Oysters, Clams, Phytoplankton, Diatoms, Radioactivity effects, Thermal stress, Radioactivity techniques, Nuclear wastes, Public health, Larvae, Primary productivity, Zinc radioisotopes, Radium radioisotopes, On-site investigations.
Identifiers: Mercury, Polonium radioisotopes, Scandium radioisotopes, Chromium radioisotopes.

Hanford-produced radionuclides were monitored in the field, and the effects of radiation and temperature stresses upon oyster larvae and phytoplankton were evaluated in the laboratory. Several projects are reported, some of wich are described in greater detail in separate reports: Effects of Ionizing Radiation and Temperature on Young Oysters (RLO-2225-T1-3, May 1971. 24 p), Effects of Ionizing Radiation and Temperature on Primary Productivity in the Aquatic Environment (RLO-2225-T1-4, May 1971, 17 p), Biological Half-life for Zn and Hg in Oysters (RLO-2225-T-1-5, May 1970, 20p), Rate of Loss of Mercury by Pacific Oysters, (RLO-2225-T1-6, Feb. 1971, 10 p), Radiological Aspects of Nuclear Power and the Aquatic Environment (RLO-2225-T1-1, 1969, 15 p), Zn-65-Mussel Monitoring Program, Dose Measurement by Thermoluminescent Dosimeters, Concentration Factors and Specific Activity Values for Cr-51 and Zn-65 for Selected Organisms. Preliminary estimates are given of the concentration factors for diatoms: Sc-46, 2000; Zn-65, 510; (Zr-95)- (Nb-95), 1300. A concentration factor for the razor clam is: Zn-65, 3300. The radiation dose from sediments results from naturally occurring radionuclides for the most part. (Bopp-ORNL)
W72-04464

RADIONUCLIDE MIGRATION IN FORESTS AND RADIATION EFFECTS ON WOODY PLANTS,
Ministerstvo Vysshego i Srednego Spetsialnogo Obrazovaniya, Moscow (USSR).
F. A. Tikhomirov, R. M. AlexaKhin, and E. A. Fedorov.
Available from the National Technical Information Service as A/CONF.49/P/685, $3.00 in paper copy, $0.95 in microfiche. June 1971, Fourth United Nations International Conf. on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6-16 September 1971. 14 p, 10 ref.

Descriptors: *Forestry, *Radioecology, *Fallout, *Radioactivity effects, *Damages, Ecology effects, Absorption, Cycles, Migration, Dispersion, Distribution patterns, Migration patterns.
Identifiers: Concentration, Radionuclide induced, Radionuclide uptake, Radionuclide transfer.

Long-term experiments on forest radioecology are being carried out in the USSR and are aimed at the solution of two principal problems - studies of regularities of radionuclide distribution and migration in the forest coenoses, and studies of forest irradiation consequences which are made of effects caused by the direct irradiation and by the secondary phenomena connected with the changes of the structure and biogeocenous relations in the irradiated coenosis. Results of these experiments are presented and a summary of information obtained in a series of experiments on the radionuclide injection into stands by spraying the crowns with radioactive solutions and by injecting them under the forest canopy. Also presented are the data of observations on the man-made radionuclide distribution and migration in the forests from global and single local fallouts. The radionuclide migration, turnover, dosimetry, and fallout damage and effects are discussed. (Houser-ORNL)
W72-04466

THE MANAGEMENT OF RADIOACTIVE WASTES AND THEIR LONG-TERM STORAGE,
Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
Y. Sousselier, and J. Pradel.
Available from the National Technical Information Service as A/CONF.49/P/766, $3.00 in paper copy, $0.95 in microfiche. Report A/CONF.49/P/766, July 1971, Fourth International Conference on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, September 6-16, 1971. 16 p, 2 tab.

Descriptors: *Nuclear powerplants, *Electric powerplants, *Nuclear reactors, *Nuclear wastes, Waste water treatment, Waste water disposal, Water pollution, Water pollution sources, Population, Effluents, Environmental effects.
Identifiers: Waste management, Waste handling, Waste transportation, Waste storage, Leak, Leach, Population exposure.

The management of radioactive wastes and their storage are questions which do not at present raise urgent and important problems. In the initial stages of the development of nuclear energy, those responsible carefully considered all aspects of the question. A very wide range of processes is available for treatment and packaging, along with data on the various possibilities for storage, not forgetting extremely accurate detection equipment, which is a definite advantage. However, with the rapid growth of nuclear energy which is expected over the coming years, new problems will arise. Some of them, such as gaseous wastes from reprocessing plants, require further technological studies, while other promising methods, such as the injection of tritium-laden effluents into the ground at great depths, have to be developed. International cooperation could take various forms depending on circumstance, and should be extended in a number of these fields. (Houser-ORNL)
W72-04468

ENVIRONMENTAL EXPOSURE BY RADIONUCLIDES IN GASEOUS AND LIQUID EFFLUENTS FROM NUCLEAR POWER PLANTS IN THE FEDERAL REPUBLIC OF GERMANY,
Bundesgesundheitsamt, Berlin (West Germany).
K. Aurand, M. Ruf, W. Schikarsk, and J. Schwibach.
Available from the National Technical Information Service as A/CONF.49/P/399, $3.00 in paper copy, $0.95 in microfiche. Report A/CONF.49/P/399, April 1971, Fourth United Nations International Conf. on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6-16 September 1971. 17 p, 8 tab, 1 fig, 7 ref.

Descriptors: *Nuclear powerplants, *Nuclear reactors, *Nuclear wastes, *Effluents, *Waste water (Pollution), Water pollution sources, Environmental effects, Population, Food chains, Genetics, Air pollution effects, Fallout, Soil contamination, Regulation.
Identifiers: Liquid effluent, Gaseous effluent, Concentration, Administrative control.

Radionuclides in gaseous and liquid effluents from nuclear power plants either directly or through contamination of the environmental media may effect an exposure of biological organism to ionising radiation or give rise to disturbances of industrial processes e.g. the production of photographic emulsions. In general, exposure of human beings to ionising radiation will be the most limiting factor. For an individual the risk of ill-effects of radiation exposure will depend on the dose received by himself. The manifestation of certain genetic ill-effects, on the other hand, will depend on the genetically significant dose to the population. And, some risk or small probability of ill-effects is associated even with low radiation doses. These effects and those of naturally occurring radionuclides in the soil, water, and atmosphere are discussed. (Houser-ORNL)
W72-04472

STRONTIUM-90 AND CESIUM-137 IN THE AUSTRALIAN ENVIRONMENT DURING 1969 AND SOME RESULTS FOR 1970,
Atomic Weapons Tests Safety Committee, Asoct Vale (Australia).
For primary bibliographic entry see Field 05B.
W72-04473

DYNAMICS OF THE FORAGE-COW-MILK-PATHWAY FOR TRANSFER OF RADIOACTIVE IODINE, STRONTIUM, AND CESIUM TO MAN,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05B.
W72-04474

TRANSFER OF RADIOACTIVE MATERIALS FROM THE TERRESTRIAL ENVIRONMENT TO ANIMALS AND MAN,
Collaborative Radiological Health Animal Research Lab., Fort Collins, Colo.
For primary bibliographic entry see Field 05B.
W72-04477

RADIATION PROTECTION EXPERIENCE IN ITALIAN NUCLEAR POWER PLANTS,
Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
M. Cometto, G. Toccafondi, O. Ilari, and S. Tagliati.
Available from the National Technical Information Service as A/CONF.49/P/191, $3.00 in paper copy, $0.95 in microfiche. Report A/CONF.49/P/191, May 1971, Fourth United Nations International Conference on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6-16 September 1971. 28 p, 5 fig, 10 tab, 8 ref.

Descriptors: *Nuclear powerplants, *Effluents, *Air pollution, *Water pollution, *Water pollution sources, Measurement, Population, Radioactivity effect, Regulation, Italy.
Identifiers: Monitor personnel, Personnel exposure, Concentration.

Experience gained in Italy in the field of radiation protection, both of nuclear power plant workers and surrounding population, amounts to 21 reactor years. During this period there were ample opportunities to cope with a wide spectrum of different situations, including major overhaul, inspection and repair works. The operating history of the three nuclear power stations is summarized. Health physics records show that the nuclear power plants in Italy were operated without any undue risk to the station personnel and to the surrounding populations. (Houser-ORNL)
W72-04478

BIOLOGICAL EFFECTS AND BEHAVIOR OF RADIOACTIVE FISSION PRODUCTS IN THE AGRICULTURE CHAINS,
Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow.
E. A. Fedorov, B. S. Prister, G. N. Romznov, N. I. Boron, and V. A. Ukhanova.
Available from the National Technical Information Service as A/CONF.49/P/686, $3.00 in paper copy, $0.95 in microfiche. Report A/CONF.49/P/686, June 1971. Fourth United Nations International Conference on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6-16 September 1971. 18 p, 6 tab, 16 ref.

Descriptors: *Radioisotopes, *Fallout, Soil contamination, *Water quality, *Balance of nature, *Ecology, *Effects, *Food chains, *Population, Radioecology, Water pollution effects, Pollutants, Path of pollutants, Water pollution sources, Animals, Plants, Public health, Absorption, Analytical techniques, Strontium radioisotopes, Cesium, Iodine radioisotopes, Uranium radioisotopes.
Identifiers: Concentration.

Insufficient data and studies on the problems of biological effects of nuclear fission products on plant and animal organisms are pointed out. Results of global fallout observations, and of long-term field and laboratory experiments on radionuclide migration along biological chains at their root and non-root entry into plants and of the biological effects of fission products on agricultural animals and plants are discussed. Nitrate solutions of some radionuclides and of a mixture of fresh 235U fission products of 10 hours age were used in the experiments; these solutions were fed to the animals or sprayed with special devices on a field of 50-200 sq. m plots. (Houser-ORNL)
W72-04479

NUCLEAR OPERATIONS IN RURAL INDIA AND CONSERVATION OF AQUATIC ENVIRONMENT,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
P. R. Kamath, I. S. Bhat, and A. K. Ganguly.
Available from the National Technical Information Service as A/CONF. 49/P/536, $3.00 in paper copy, $0.95 in microfiche. Report A/CONF.49/P/536, May 1971, Fourth United Nations International Conference on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6-16 September 1971. 28 p, 4 fig, 2 tab, 8 ref.

Descriptors: *Nuclear powerplants, *Radioactivity, *Radioactivity effects, *Effluents, *Environment, *Population, Food chains, Water pollution, Water pollution sources, Public health, Fallout, Pollutants, Water conservation, Aquatic environment.
Identifiers: Concentration, Radionuclide, Surveillance program, Public relations, Radiation in perspective, *India.

Installation of nuclear power stations and associated facilities raises a genuine concern regarding deleterious effects from radioactive releases. Selection of proper sites demands careful safety evaluation of a project. Safety criteria ensure that the population is not likely to be exposed above the permissible levels and no undue restrictions are imposed on utilization of the environment. (Houser-ORNL)
W72-04480

RADIOACTIVITY OF OCEAN WATERS AND BEHAVIOR OF SOME FISSION PRODUCTS,
Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow.
For primary bibliographic entry see Field 05B.
W72-04482

PUBLIC HEALTH IMPLICATIONS OF RADIOACTIVE WASTE RELEASES.
World Health Organization, Geneva (Switzerland).

Available from the National Technical Information Service as A/CONF.49/P/652, $3.00 in paper copy, $0.95 in microfiche. Report A/Conf.49/P/652, August 1971, Fourth United Nations International Conf. on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6-16 September 1971. 14 p, 2 fig, 2 tab, 18 ref.

Descriptors: *Radioactivity, *Radioactivity effects, *Environment, *Environmental effects, *Nuclear powerplants, Effluents, Waste water (Pollution), Water pollution sources, Natural resources, Food chains, Path of pollutants, Air pollution, Contamination (Soil).
Identifiers: Organ, Concentration, Contamination.

This report raises questions about and focuses attention on various aspects of radioactive environmental contamination of concern to public health authorities. These include not only radiation doses to man or to other living organisms but also the impairment of present and potential natural resources. This report concentrates on the most important public health aspect, namely, whole-body radiation doses to man from reactor and fuel reprocessing plants. It is recognized, however, that this may not be the most important aspect in some local situations; there specific analyses should be carried out to determine what the most important public health effects are. In such situations there is a need for specific information on, for example, environmental pathways, so that the various public health effects as well as the radiation exposure of specific organs can be evaluated. Often the critical group, the critical vector, the critical nuclide and the critical organ are different. (Houser-ORNL)
W72-04483

RADIOACTIVITY IN THE MARINE ENVIRONMENT.
National Academy of Sciences-National Research Council, Washington, D. C. Committee on Oceanography; and National Academy of Sciences-National Research Council, Washington, D. C. Panel on Radioactivity in the Marine E nvironment.
For primary bibliographic entry see Field 05B.
W72-04484

ACCUMULATION AND REDISTRIBUTION OF RADIONUCLIDES BY MARINE ORGANISMS,
For primary bibliographic entry see Field 05B.
W72-04490

ECOLOGICAL INTERACTIONS OF MARINE RADIOACTIVITY,
For primary bibliographic entry see Field 05B.
W72-04491

RADIATION EFFECTS,
For primary bibliographic entry see Field 05B.
W72-04492

BIOLOGICAL CONCENTRATION OF PESTICIDES BY ALGAE,
North Texas State Univ., Denton. Department of Biology.
For primary bibliographic entry see Field 05B.
W72-04506

EFFECTS OF TRACE ADDITIVES AND IMPURITIES ON THE PROPERTIES OF HIGH PURITY WATER,
Army Engineer Reactors Group, Fort Belvoir, Va.
B. M. Coursey.
Available from the National Technical Information Service as AD-731 798, $3.00 in paper copy, $0.95 in microfiche. Army Engineer Reactors Group Report No. ED-7105, 25 August 1971, 38 p.

Descriptors: *Trace elements, *Pollutants, *Water pollution effects, *Water pollution sources, *Nuclear power plants, Chemical properties, Physical properties.
Identifiers: *High purity water.

Production and storage of large volumes of very pure water is a continuing problem in a nuclear power plant. Trace impurities drastically affect the properties of water. This study examines: (1) temperature dependence of pH and conductivity for pure water; (2) solubility of dissolved atmospheric contaminants and the hydrogen blanket; and (3) the effects of trace chemicals on pH and the conductivity of water. (Cowgill-OWRR)
W72-04554

EFFECTS OF METAL CATIONS AND OTHER CHEMICALS UPON THE IN VITRO ACTIVITY OF TWO ENZYMES IN THE BLOOD PLASMA OF THE WHITE SUCKER, CATOSTOMUS COMMERSONI (LACEPEDE),
National Water Quality Lab., Duluth, Minn.
G. M. Christensen.
Chemico-Biological Interactions, Vol 4, p 351-361, 1971-1972. 6 fig, 2 tab, 36 ref.

Descriptors: *Metals, *Enzymes, Fish physiology, Toxicity, Heavy metals, *Suckers, Fish, Industrial wastes.
Identifiers: *Silver, *Mercury, *Palladium, Catostomus commersoni.

Relative changes in the activity of glutamic oxalacetic transaminase (GOT, L-aspartate-2-oxoglutarate aminotransferase) and lactic dehydrogenase (LDH, L-lactate-NAD oxidoreductase) in blood plasma from white suckers were determined after incubation with 49 compounds, principally inorganic chlorides, at concentrations of the ions up to 2 mg/ml in the reaction mixture. A sequence of inhibitory effect was arranged for each enzyme. Dose-response curves were qualitatively similar for most of the chemicals. GOT was most sensitive to silver and mercury, and LDH to palladium and mercury. Both enzymes are highly inhibited by metals which are highly toxic to aquatic animals. Correlations were studied between the inhibitory effect and certain physicochemical properties of chemicals, the best being found between the inhibition of GOT and the equilibrium constants of metal sulfides. (EPA abstract)
W72-04557

PLANT NUTRIENTS AND ANIMAL WASTE DISPOSAL,
Connecticut Agricultural Experiment Station, New Haven.
Charles R. Frink.
Connecticut Agricultural Experiment Station Circular 237, May 1970. 10 p, 1 tab, 1 fig, 13 ref.

Descriptors: *Farm wastes, *Waste disposal, *Environmental effects, *Public health, *Nutrients, *Connecticut, Sewage treatment, Fertilizers, Nitrogen, Dairy industry, Phosphorus.
Identifiers: *Plant nutrients.

Plant nutrients released to the aquatic environment permit the growth of abundant weeds and algae and complicate present efforts to provide clean water for Connecticut citizens. These nutrient sources include domestic sewage, animal wastes, fertilizers used on both farm and lawns, and nitrogen oxides from high temperature combustion. Although the economic return from the plant nutrients in farm manure is marginal at best, we can no longer afford the consequences of regarding manure simply as waste to be disposed. Continuing efforts should be made to keep adequate land area in crops. Methods of assessing the human health hazard from the disposal of farm wastes should be examined. Research on methods for storage and handling farm manure should be continued, with the ultimate aim at storage and distribution system so that manure is applied to growing crops and not to bare or frozen soil. Research should be continued on new agronomic practices to improve the uptake by the crop of the nutients in the applied manure. (Parker-Iowa State)
W72-04573

A NOTE ON THE LIMNOLOGY OF LAKE HAYQ, ETHIOPIA,
Haile Sellassie I Univ., Addis Ababa (Ethiopia). Dept. of Chemistry.
For primary bibliographic entry see Field 02H.
W72-04599

LAND DISPOSAL OF MANURE IN RELATION TO WATER QUALITY,
Cornell Univ., Ithaca, N.Y. Dept. of Soil Science.
For primary bibliographic entry see Field 05D.
W72-04611

EFFECTS OF AGRICULTURAL PRACTICES ON AQUIFERS,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering.
J. Kriz.
Preprint No. 71-760. For presentation at 1971 Winter Meeting, American Society of Agricultural Engineers, December 7-10, 1971, Chicago, Illinois, 18 p, 88 ref.

Descriptors: *Water pollution effects, *Agricultural chemicals, *Animal wastes, *Fertilizers, *Pesticide residues, *Path of pollutants, Groundwater movement.
Identifiers: *Groundwater pollution, *Groundwater quality.

Recent literature (primarily 1968 to 1971) on the effects of animal wastes, fertilizers, pesticides, bacteria and viruses and saline waste water on aquifers is reviewed and discussed with respect to type of waste, climatic conditions, soil-water movement and geologic conditions. (Howells-North Carolina)
W72-04633

CONSEQUENCES OF MERCURY POLLUTION AND LEGAL REMEDIES,
Vanderbilt Univ., Nashville, Tenn. School of Law.
For primary bibliographic entry see Field 05G.
W72-04637

THE CARBON CYCLE OF A GEORGIA FISH POND,
Georgia Univ., Athens. Dept. of Zoology.
J. E. Schindler.
Summary report, August 24, 1971, 4 p. OWRR A-029-GA (1).

Descriptors: *Carbon, *Nutrients, *Organic matter, *Anaerobic sediments, *Sediment-water interfaces, Heavy metals, Food chains, Organic compounds, Georgia, Oxidation-reduction potential, Aquatic environment, Limnology.

The objective was to follow the carbon cycle of a Georgia fish pond to determine quantitatively the rates of exchange of carbon through the components of the cycle and to equate the changes to the primary production of the pond. Metallics released from anaerobic sediments of lakes have been found to be associated with high molecular weight organic complexes. During the decrease in oxidation-reduction potential of the sediments, the concentration of certain metallics (Fe, Mg, Mn) in the water appeared to be associated with 10,000 to 50,000 molecular weight organics. Preliminary studies have shown mercury to be associated with high molecular weight organic complexes. (Conway-Georgia)
W72-04638

EFFECT OF EARLY DAY MINING OPERATIONS ON PRESENT DAY WATER QUALITY,
Idaho Univ., Moscow. Coll. of Mines.
L. L. Mink, R. E. Williams, and A. T. Wallace.
Ground Water, Vol 10, No 1, p 17-26, January-February 1972. 9 fig, 2 tab, 13 ref. Bur. of Mines Cont. No H0110088.

Descriptors: *Water pollution sources, *Mine drainage, *Leaching, *Mine wastes, *Idaho, Mine water, Waste dumps, Alluvium, Water pollution effects.
Identifiers: Coeur d'Alene (Idaho).

Mining operations within the Coeur d'Alene District of northern Idaho have been continuous for over 85 years. Early day mining and milling wastes are now affecting the groundwater quality in several locations. One of the affected areas is the lower Canyon Creek Basin near Wallace, Idaho. Groundwater pollution of the Canyon Creek Basin results from leaching of old mine tailings. High zinc, lead and cadmium concentrations occur in groundwater and soil samples taken from the portion of the sand and gravel aquifer containing old mine tailings. Analysis of water samples from a settling pond in the upper portion of the study area indicates that the pond water is not the source of the heavy metal concentrations found in the groundwater. However, the water from the pond's decanting system provides recharge to groundwater and compounds the problem. (Knapp-USGS)
W72-04655

5D. Waste Treatment Processes

EFFLUENT QUALITY CONTROL AT A LARGE OIL REFINERY,
Weston (Roy F.), Inc., West Chester, Pa.
D. S. Diehl, R. T. Denbo, M. N. Bhatia, and W. D. Sitman.

Journal of the Water Pollution Control Federation, Vol. 43, No. 11, p 2254-2270, November 1971. 11 figs, 7 tab.

Descriptors: *Waste water treatment, *Water pollution control, Separation techniques, Silts, Lagoons, Mississippi River, Effluents, Biochemical oxygen demand, Chemical oxygen demand, Phenols, Heavy metals, Hydrogen sulfide, Flow measurement, Weirs, Taste, Odor, Activated carbon, Activated sludge, Biological treatment, Incineration, Coagulation, Flotation, Reverse osmosis, Filtration, Suspended solids, Oily water, Water quality, *Oil wastes, Industrial wastes, Rivers, Louisiana.
Identifiers: *Refineries, Strippers, Gurley meter, Ozonation, Air stripping, Fluid bed incineration, Multiple hearth incineration, *Baton Rouge (La).

Humble Oil's Baton Rouge refinery has undertaken a comprehensive program, with the help of an environmental engineering consulting firm, to upgrade the quality of its wastewater. The objectives were to define critical effluent parameters, investigate treatment processes, reduce water pollution at the source, and design effective treatment facilities. A six-phase approach, which is described in detail, was adopted. It includes: (1) characterizing the wastewater, (2) studying taste and odor, (3) evaluating biological treatment processes, (4) investigating alternatives to biological treatment, (5) reducing in-plant waste load, and (6) selecting additional treatment processes. This program is expected to reduce the refinery's effluent flow by 90 percent, oil load by 80 percent, odor units by 70 percent, phenol load by 40 percent, and BOD load by 30 percent. (Mortland-Battelle)
W72-04146

DESIGN AND FABRICATION OF A FLIGHT CONCEPT PROTOTYPE VAPOR DIFFUSION WATER RECLAMATION SYSTEM,
United Aircraft Corp., Windsor Locks, Conn. Hamilton Standard Div.
H. J. Kolnsberg, and D. R. McCann.
Available from NTIS, Springfield, Va. 22151 as N71-33400, $3.00 in paper copy, $0.95 in microfiche. National Aeronautics and Space Administration Contract Report CR-111932, August 1971. 78 p, 29 fig, 7 tab, 6 append. NASA Contract NAS 1-8943.

Descriptors: *Water reuse, *Reclaimed water, *Urine, *Aircraft, Analytical techniques, Chemicals, Membrane processes, Diffusion, *Waste water treatment.
Identifiers: *Space program (NASA).

A flight concept prototype vapor diffusion water reclamation (VDR) system was designed, fabricated and subjected to a 90 day continuous run reliability test. The automated system utilizes a polyvinyl chloride membrane material. The test program enabled the system to meet or exceed the design specifications of 95% recovery efficiency and 229 grams per hour average processing rate. A 96.6% recovery efficiency and 306 grams per hour average processing rate were achieved during the best of the eight urine fill to solids dump cycles completed. Manual operations and maintenance required an average time of only 6.6 minutes per day. Subsequent refurbishment of the system has eliminated fittings and restrictions in the urine flow loop responsible for 4.7 minutes per day of maintenance time. Membrane life for the test averaged 60 days, with one of the original four membrane modules lasting the entire 90 days. The system demonstrated resistance to the transmittal of bacteria by successfully resisting a challenge with viable micro-organisms and by utilizing an automatic sterilization procedure to effectively clean the product water side of the system after an accidental contamination. Based on the results of this program, the VDR concept is a viable system for spacecraft water reclamation. (Woodard-USGS)
W72-04171

METABOLIC FACTORS AFFECTING ENHANCED PHOSPHORUS UPTAKE BY ACTIVATED SLUDGE,
Arizona Univ., Tucson. Dept. of Microbiology and Medical Technology.
W. H. Boughton, R. J. Gottfried, N. A. Sinclair, and I. Yall.
Applied Microbiology, Vol 22, No 4, p 571-577, October, 1971. 4 fig, 5 tab, 16 ref. EPA, 17010 DDQ.

Descriptors: *Phosphorus, *Activated sludge, Phosphorus radioisotopes, Phosphates, Inhibitors, Hydrogen ion concentration, Heat, Metabolism, Texas, California, Waste water treatment.
Identifiers: *Biological uptake, Mercuric chloride, Iodoacetic acid, p-Chloromercuribenzoic acid, Sodium azide, 2-4-Dinitrophenol, Sodium chloride, Sulfhydryl enzymes, San Antonio (Texas), Los Angeles (Calif).

Activated sludges obtained from the Rilling Road plant located at San Antonio, Tex., and from the Hyperion treatment plant located at Los Angeles, Calif., have the ability to remove all of the orthophosphate normally present in Tucson sewage within 3 hr after being added to the waste water. Phosphorus removal was independent of externally supplied sources of energy and ions, since orthophosphate and 32p radioactivity were readily removed from tap water, glass-distilled water, and deionized water. Phosphorus uptake by Rilling sludge in the laboratory appears to be wholly biological, as it has an optimum pH range (7.7 to 9.7) and an optimum temperature range (24 to 37 C). It was inhibited by HgCl2, iodoacetic acid, p-chloromercuribenzoic acid, NaN3, and 2,4-dinitrophenol (compounds that affect bacterial membrane permeability, sulfhydryl enzymes, and adenosine triphosphate synthesis). Uptake was inhibited by 1% NaCl but was not affected by 10-3M ethyl-enediaminetetraacetic acid disodium salt (a chelating agent for many metallic ions). (EPA abstract)
W72-04210

VOLUTIN GRANULES IN ZOOGLOEA RAMIGERA,
Arizona Univ., Tucson. Dept. of Microbiology and Medical Technology.
F. A. Roinestadt, and I. Yall.
Applied Microbiology, Vol 19, No 6, p 973-979, June 1970. 6 fig, 15 ref. EPA, 17010 DDQ.

Descriptors: *Bacteria, *Phosphates, Activated sludge, Pseudomonas, Phosphorus radioisotopes, Sulfates, Magnesium, Sewage, Waste water treatment.
Identifiers: *Zoogloea ramigera, *Volutin formation, Aerobacter aerogenes, Gram negative, Inorganic polyphosphates, Glucose.

Zoogloea ramigera, a gram-negative bacterium found in activated sludge, formed volutin granules when excess orthophosphate was added to a phosphate-starved culture. These volutin granules were stainable by hydrogen sulfide after lead acetate treatment and extractable by N-perchloric acid but were not adsorbed by activated charcoal. They appeared to consist of inorganic polyphosphate. Optimum granule formation in the arginine broth required 10 g of glucose, 3 mg of phosphate, and 1 to 20 mg of magnesium per liter of medium. At an Mg2+ concentration of lmg/liter, very large granules appeared which often appeared to fill the cell. An excess of glucose, orthophosphate, or magnesium reduced granule formation. In the absence of sulfate, moderate granulation occurred in arginine broth before the addition of excess orthophosphate; granulation did not increase after the addition of phosphate. (EPA abstract)
W72-04211

WASTEWATER TREATMENT PLANT PERSONNEL: IMAGE AND TRAINING,
Buffalo Sewer Authority, N.Y.
Gillman J. Laehy.
Journal Water Pollution Control Federation, Vol 43, No 7, July 1971, p 1439-1443. 2 ref.

Descriptors: *Personnel, *Engineering education, *Training, Water pollution control, Research and development, Operation and maintenance, Leadership, Management, Waste water treatment, *Treatment facilities.

In order to successfully advance the technology of water pollution control, young people must be attracted to the field to supply the necessary highly skilled operational and research manpower needed. In attracting people to careers, a pleasing image and social merit for the job is needed. The pollution control industry, therefore is attempting to upgrade the image set before the public through far-reaching training and educational programs, mainly at the college level. Federal assistance has been available for plant operator training at specialized training centers also. In addition, public relations efforts are continuing to upgrade the image of the modern pollution control worker in the eyes of the general public, and these efforts are currently the most important since they will in a larger measure, determine the number of people who will be willing to listen and look for career opportunities in the pollution control industry. (Lowry-Texas)
W72-04220

DEVELOP SAFETY CODE FOR CHEMICALS AT DISPOSAL SITES,
New Jersey State Dept. of Health, Trenton.
R. P. Kandle.
Solid Wastes Management/Refuse Removal Journal, Vol 11, No 4, April 1968, p 24-25.

Descriptors: *Solid wastes, *Chemicals, *Landfills, Incineration safety, Hazards, Public health, Air pollution, Regulation, On-site tests.
Identifiers: Color code by type.

The safe disposal of chemicals and chemical mixtures has been a troublesome matter to the New Jersey State Department of Health for a long time. The origin of stubborn fires and serious explosions at landfill sites could often be traced to the disposal of chemical wastes. This is a health problem and an air pollution problem. It could be a matter of life and death. A joint industry-state committee was established to review the problem and suggest solutions. This Task Force on Chemical Wastes was needed in order to develop a simple, practical method of communicating between producers of chemical wastes, haulers of it, and the disposal site operators. The Task Force agreed on a set of regulations similar to those of the Interstate Commerce Commission for inflammable or hazardous materials. The regulations call for the color coding of flammable liquids, gases, flammable solids, acids, corrosive liquids, alkaline caustic liquids, non-flammable gases and poisons. The waste producer color codes the material and provides the hauler with a bill of lading identifying the substances. The hauler must transport these materials on suitably marked vehicles and turn over the bill of lading to the disposal site operator. The state assists the disposal site operator and industry by maintaining an information center for disposal of chemical wastes. These regulations will be tested for a period of six months. (Goessling-Texas)
W72-04221

FITNESS NEEDS FOR WASTEWATER RECLAMATION PLANTS,
California State Dept. of Public Health, Berkeley. Bureau of Sanitary Engineers.
W. F. Jopling, D. G. Deaner, and H. J. Angerth.
Journal of the American Water Works Association, Vol 63, No 10, October, 1971, p 626-629. 1 ref.

Descriptors: *California, *Water reuse, *Sewage treatment, Sewage effluent, Irrigation, Golf courses, Parks, Lakes, Chlorination, Design criteria,

Public health, Groundwater, Water pollution, *Treatment facilities.
Identifiers: *Santee (Calif), Hypochlorinator, *San Francisco, Alarms, Central Valley.

Results of intensive investigations by the California State Department of Public Health show the need for improved reliability features at wastewater-reclamation operations for public health protection. The trend in water reclamation has been toward uses where there is public exposure, such as golfcourses, parks and freeway landscape. However, the Department of Public Health was greatly concerned with the lack of any direct controls over the reliability of the reclamation systems. In 1964, a study of the public health aspects of sewage collection and disposal in Central Valley revealed that 56% of the plants had experienced serious equipment outages during the preceding year. Chlorination equipment was reported out of service by eighteen plants. Reportedly, the department has found 30-60% of the sewage-treatment plants have serious failures sometime during the year. The State Water Resources Control Board's study panel responded to this well-documented concern by recommending legislation, which was subsequently adopted and which authorized the establishment of reclamation criteria. Two intensive studies of reclamation operations were conducted in order to determine the types of reliability features that are used and where controls are needed. Proposed reclamation criteria are directed at features of alarms, emergency power supply, short-term retention and long-term emergency disposal, stand-by equipment and multiple units. The degree of reliability is dependent on the degree of public exposure to the reclaimed water. (Biggs-Texas)
W72-04222

BIOLOGICAL-CHEMICAL WASTEWATER TREATMENT,
Neptune Microfloc, Inc., Corvallis, Oreg.
John R. Stukenberg.
Journal Water Pollution Control Federation, Vol 43, No. 9, September 1971. p 1791-1806, 11 fig, 5 tab, 23 ref.

Descriptors: *Activated sludge, *Lime, *Coagulation, Chemical precipitation, Biochemical oxygen demand, Chemical oxygen demand, Nutrients, Phosphates, Color, Cost analysis, Construction costs, Tertiary treatment, *Waste water treatment, *Biological treatment, Oregon.
Identifiers: *Chemical treatment, Combined treatment, *Corvallis (Oreg), Philomath (Oreg).

Laboratory and field tests of a combination of high rate activated sludge (HRAS)-lime coagulation wastewater treatment scheme was conducted for a period of one year. When operating on a raw wastewater with 140 mg/l BOD, 2.5 hr. aeration HRAS followed by lime coagulation produced an average effluent BOD of 4.3 mg/l. Suspended solids, COD, color and phosphate contents of the wastewater were also efficiently reduced, resulting in a readily settleable and filterable lime sludge. Merits of the system included: (1) relatively high effluent quality with moderate costs as compared with other tertiary treatment methods; (2) stability of operation with a 70% minimum BOD reduction guaranteed by the coagulation step alone; (3) comparatively simple operation, (4) reduction of the number of waste sludge streams to be handled later; (5) flexibility in the straight chemical, or straight biological treatment can be selected with carbon adsorption as an added option; and (6) the process can be easily adapted to existing activated sludge plants. Costs for a 10 mgd plant averaging 95% BOD and 90% COD reductions with a minimum detention time of 1.5 hours are $3.3 million for construction and $.18/1000 gal. of operation. (Lowry-Texas)
W72-04224

AN UNCONVENTIONAL APPROACH,
Cornell, Howland, Hayes and Merryfield, Corvallis, Oreg.
J. L. Graham, and J. W. Filbert.
The American City, Vol 85, No. 10, October 1970, p 72-75, 4 fig, 1 ref.

Descriptors: *Waste water treatment, Municipal wastes, Canneries, *Aerobic treatment, Effluents, Biochemical oxygen demand, Cost comparison, Oregon, Industrial wastes, *Treatment facilities, *Oxidation lagoons, Aeration.
Identifiers: *Dallas (Oreg).

The city of Dallas, Oregon constructed a completely aerobic wastewater treatment plant. Dallas a city of 6,000 has a canning plant which increased the BOD load on the wastewater treatment plant by a factor of three during the season. The design to accommodate this wide fluctuation includes two aeration basins (each serviced by four 25 hp floating aerators), a clarifier, an aerobic sludge digestion tank, a chlorine and two sludge lagoons. The system is automated wherever possible which allows the plant to operate 24 hours a day with operators in attendance only 48 hours a week. The plant has been in operation for six months and has consistently met the state standards of 20 mg/l SS and 20 mg/l BOD. A conventional plant of the same size would have cost $950,000 as compared to the actual costs, $610,000, of this design. Operation and maintenance costs are $20 per million gallons versus an estimated $75 per million gallons for a conventional design. (Goessling-Texas)
W72-04225

STORM-WATER RETENTION CAN WORK,
Detroit Metro Water Dept., Mich.
G. Ramus.
The American City, October 1970. Vol 85, No 10, p 68-69, 2 fig.

Descriptors: *Waste water treatment, *Sewers, *Storm drains, Flow control, Rain gages, Flow measurement, Data collection, Decision making, Scheduling, *Overflow, Retention, Michigan, Treatment facilities, Water conveyance.
Identifiers: *Combined sewers, *Detroit (Mich).

The City of Detroit, Michigan has developed a $2.1 million system to assist in collecting data to control discharges from the combined municipal sewer system into the Rouge and Detroit Rivers due to storm water runoff. The system consists of rainfall gages positioned throughout the city and along the incoming path of storm to provide an estimate of the intensity of rainfall, sewer level gages at key points in the sewer system to monitor the ability of the sewer system to absorb runoff, communications and a computer. Information from the sensors is supplied to a central control center over leased telephone lines, where it is converted from analog data to digital information and printed onto IBM punch cards. At the present time, control operators read the cards and act on the information to anticipate overflow situations, selectively retain sewage in the system for later treatment or to selectively discharge sewage to the rivers. The use of this information and control system over the past year has enabled the city staff to learn more about the relationships between rainfall, sewage levels and overflows to the rivers and it has provided for a reduction in the number and volume of overflows. Future plans call for the inclusion of a digital computer in the system to aid in decision making. (Goessling-Texas)
W72-04226

A REVIEW OF THE DECOMPOSITION OF CELLULOSE AND REFUSE,
Manhattan Coll., New York.
R. W. Regan, and J. S. Jeris.
Compost Science, Vol 11, No 1, January-February 1970. p 17-20, 3 fig, 4 tab, 30 ref.

Descriptors: *Solid waste, *Municipal wastes, *Biodegradation, Sludge disposal, Pulp wastes, Paper, Cellulose, Laboratory tests, Design, Optimization, Economics, *Decomposing organic matter, Degradation (Decomposition), *Waste treatment, Waste disposal.
Identifiers: *Composting.

The use of composting to convert organic solid waste into a fertilizer, soil conditioner or nutrient source, is a topic of discussion and controversy. The real value of this process is disposal of solid waste with the production of a usable, non-objectionable and hygenically safe residue. While much of the previous research on the composting process is generally valid, the exceptionally large percentage of paper and other cellulolytic material (up to 70%) in today's refuse indicate the necessity for additional study. In recent years only limited success of large scale composting as a means of solid waste disposal has been reported. The primary reason for the lack of success appears to be the failure to use scientific knowledge of the factors affecting the microbial life present in composting. Incorporation of these factors in the design of a composting plant could lead to an optimized process for treating today's highly cellulolytic refuse. When the economics of this process are established on a rational design basis, the true potential of composting municipal refuse should be realized. (Goessling-Texas)
W72-04227

NEW EFFLUENT PLANT AT SCHWEITZER MEETS QUALITY STANDARDS.
Kimberly Clark Corp., Lee, Mass. Peter J. Schweitzer Div.

Paper Trade Journal, Vol 154, No 47, November 23, 1970. p 39, 2 fig.

Descriptors: *Pulp wastes, Pulp and paper industry, Water pollution control, Flocculation, Chemical precipitation, Sedimentation, Dewatering, Sludge disposal, Industrial wastes, *Waste water treatment, Massachusetts, *Treatment facilities, *Standards.
Identifiers: *Suspended solids, *Lee (Mass).

A complex of 4 mills in Lee, Massachusetts, producing specialized paper products, is now sharing a centralized waste treatment facility. Approximately 6 mgd is pumped to a central control house for sampling, metering, and addition of flocculating chemicals. The main clarifier underflow averages 1% solids, and this underflow is pumped to a thickener for concentration to 3% solids. The 3% sludge is fed to a Bird, solid bowl centrifuge at 75 gpm and dewatered to 20% solids, with solids recovery averaging 90%. The system yield of approximately 10cu yd of material per day has stimulated interest in re-use rather than disposal in a landfill. Based on the success of this plant, a similar installation is being constructed at another Schweitzer mill. (Lowry-Texas)
W72-04228

PULP MILL EFFLUENTS-WHAT THEY ARE, AND HOW THEY ARE HANDLED AND TREATED,
Kalamazoo Associates, Inc., Mich.
Anthony J. Palladino.
Pulp and Paper, Vol 44, No 2, February 1970. p 119-123, 42 ref.

Descriptors: *Pulp wastes, Pulp and Paper industry, *Wood wastes, *Sulfite liquors, *Industrial wastes, Municipal wastes, Color, Odors, Lime, Chemical precipitation, Farm fractionation, Activated carbon, Sprinkler irrigation, Incineration, Landfills, *Waste water treatment.
Identifiers: Kraft mill effluents.

Pulp mill wastes are difficult to handle and/or treat for two reasons: (1) the high shrinkage attendant to all pulping processes causes correspondingly high effluent loads; and (2) the drastic cooking conditions which result in extremes in effluent pH, corrosiveness, temperature, color, and foaming tendencies. Kraft mill effluents have responded well to biological treatment, but residual color has prompted development of the massive lime precipitation and activated carbon color removal techniques for color removal. Other troublesome

problems include sulfite mill effluents, semichemical pulp mill effs well as fiber losses in pulp mill effluents. The advantages of joint treatment with other industrial and municipal wastes are presented along with a review of trickling filters, foam fractionation and pre-aeration. A comprehensive listing of literature dealing with these aspects is also presented. (Lowry-Texas)
W72-04229

TERMINAL WASTE TREATMENT AND SLUDGE DISPOSAL METHODS,
Door-Oliver, Inc., Stamford, Conn., Industrial Water Projects Div.
R. R. Evans.
Paper Trade Journal, Vol 154, No 31, August 3, 1970. p 28-31, 6 fig.

Descriptors: *Pulp wastes, Pulp and paper industry, Sludge disposal, Industrial wastes, Aerobic conditions, Activated sludge, Dewatering, Centrifugation, Filtration, Sedimentation, Coagulation, Temperature, Oxidation, Incineration, Instrumentation, Cost analysis, *Waste water treatment, *Waste treatment, *Heat treatment, *Sludge treatment.

The Farrar Heat Treatment method has been developed for the treatment of secondary sludge. Vacuum filtration or centrifugation of untreated sludge results in a cake of only 15 to 20% dry solids even after an expenditure of $15 per ton of dry solids for polymers. Settling tests have demonstrated that the same type of sludge, after heat treatment, will settle by gravity of 25% of its original volume, and can be centrifuged to 35 to 40% dry solids content without the use of chemicals. Recovery of solids is between 92 and 97%. The fluo-solids incinerator has also been developed to handle the incineration of such sludges by the fluidized bed method. This type of incineration is (1) simple and reliable; (2) able to handle both slurries and cakes; (3) allows selection and close maintenance of bed temperature; (4) has fast start-up and shut-down characteristics with no power or fuel required in the stand-by mode; (5) provides good effluent control; and (6) is easily automated. Cost analyses for these units in various combinations of biological treatment methods are presented. (Lowry-Texas)
W72-04230

POLLUTION PROJECT COMPLETED AT G-P'S WOODLAND, MAINE COMPLEX.
Georgia-Pacific Corp., Woodland, Me.

Paper Trade Journal, Vol 154, No 42, October 19, 1970. p 56-57, 5 fig.

Descriptors: *Pulp wastes, Pulp and paper industry, *Bark, *Color, Wood wastes, *Waste water treatment, Design criteria, Construction costs, Chemical precipitation, Water pollution control, Maine, *Treatment facilities.
Identifiers: *Extended aeration, Kraft mill liquor, *Woodland (Maine).

Georgia-Pacific Corporation completed a $5 million pollution control facility at their Woodland, Maine complex to remove settleable solids, bark fines and color, handle sanitary sewage, and provide a chemical spill collection system. The facilities consisted of a large effluent clarifier, color removal clarifier, sanitary sewage treatment plant, and kraft mill liquor spill recycling system. Sludge goes to a Komline-Sanderson coil spring filter to be thickened from 3 to 20% solids, drops into a Rietz press to be concentrated to 40 to 54% solids and is then conveyed to the powerhouse for incineration. Lime sludge from the color removal clarifier is sent to a lime kiln after dewatering, and 80% of the lime is recovered for re-use while the organic matter is oxidized. Sanitary wastes undergo extended aeration and chlorination, and the recycle system prevents upsets from kraft liquor spills. (Lowry-Texas)
W72-04231

2020 VISION/2, A LOOK AT WASTEWATER DISPOSAL 50 YEARS HENCE,
G. E. Symons.
Water and Wastes Engineering, Vol 7, No 4, April 1970. p 66-69, 3 tab.

Descriptors: *Waste water treatment, *Sewage treatment, *Tertiary treatment, *Sewers, Detergents, Domestic wastes, Digestion, Freeze drying, Oxidation, Trickling filters, Effluents, Pathogenic bacteria, Biochemical oxygen demand, Chemical oxygen demand, Sludge, Carbon dioxide, Methane, Reverse osmosis, Analysis.
Identifiers: Centrifugal force, Flocculant aids.

The possible and probable developments in wastewater disposal are presented, based on considerations of developments in the past two decades and of conditions existing today. In the future, the separation of storm and sanitary sewers will come about. This separation will be accomplished partly by the installation of small sanitary sewers operating under pressure inside of combined sewers, as proposed by the late Dr. Gordon A Fair. Storm water will either be treated in a separate treatment plant or stored in large underground caverns. The composition of wastewater will change because of further changes in household detergents and new products, yet to be invented. Not only house-hold garbage but other organic wastes may be ground and discharged into the sewers. In the future treatment of wastewaters, there will be a 'marrying' of currently available techniques to improve overall treatment. There will be quicker more efficient removal of suspended and settleable solids and colloids possibly by using centrifugal force. Freeze-drying and oxidation of solids in the liquid stage will compete with high-rate digestion. All wastewater treatment processes will be operating at higher rates. Laboratory techniques will become more automated and more instrumented. Before any new dramatic breakthroughs can be attained three problems have to be solved. The first is that of hydraulic loading on treatment plants. Secondly, there is the concentration of substances to be removed from wastewater. Finally, in the field of municipal waste treatment, there is no profit motive. (Briggs-Texas)
W72-04232

PROJECTED WASTEWATER TREATMENT COSTS IN THE ORGANIC CHEMICALS INDUSTRY (UPDATED).
Datagraphics, Inc., Pittsburgh, Pa.

Copy available from GPO Sup Doc for $1.50; microfiche from NTIS as PB-206 429, $0.95. Environmental Protection Agency - Research and Monitoring, Water Pollution Control Research Series, July 1971. 161 p, 31 fig, 40 tab, 75 ref. EPA Program 12020 GND 07/71.

Descriptors: *Industrial wastes, *Chemical wastes, *Waste water treatment, *Cost analysis, *Construction costs, Operation and maintenance, Fertilizers, Ureas, Ammonia, Sampling, Growth rates, Water pollution control, *Operating costs, Cost trends, *Forecasting.
Identifiers: *Organic chemicals industry, Waste characterization.

Data from 53 organic chemicals plants were obtained and formatted according to an Industrial Waste Treatment Practices Data Form. For this analysis, the organic chemical industry was assumed to include producers of cyclic intermediates, dyes, organic pigments (lakes and toners), and cyclic (coal tar) crudes; organic chemicals not elsewhere classified portions of industrial gases; portions of agricultural chemicals not elsewhere classified; and portions of fertilizers. Only organic gases were included from the organic gases industry and only ammonia and urea from the fertilizer industry. Projections have been based upon the chemical industry data in the 1963 and 1967 Census of Manufacturers and upon data obtained from the individual plants. Costs of treatment are estimated by year for 6 levels of treatment from removal of gross pollutants to 100% removal of contaminants. However, total costs given are for the construction and operation of waste treatment facilities for the industry as a whole and cannot be used to determine costs for individual plants. (Lowry-Texas)
W72-04297

A COMPILATION OF COST INFORMATION FOR CONVENTIONAL AND ADVANCED WASTEWATER TREATMENT PLANTS AND PROCESSES,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Water Research Lab.
R. Smith.
Available from NTIS as PB-206 430, $3.00 in paper copy, $0.95 in microfiche. Advanced Waste Treatment Laboratory, Research Division, December 1967. 9 p, 29 fig, 23 ref. EPA Program 17090---12/67.

Descriptors: Waste water treatment, *Costs, *Construction costs, *Operating costs, Operation and maintenance, Activated sludge, Trickling filter, Coagulation, Filtration, Activated carbon, Electrodialysis, Aeration, Chlorination, Pipelines, *Treatment facilities, *Comparative costs.
Identifiers: Primary sedimentation, Ammonia stripping, Microstraining.

The cost associated with building and operating wastewater treatment plants or individual wastewater processes has always been difficult to estimate for planning purposes. A great deal of information is available and an attempt has been made to assemble this information in one place using a consistent set of assumptions and omissions. It is hoped that this will prove a useful working document for engineers and scientists working in the field of wastewater treatment. Costs for conventional treatment plants include those for primary sedimentation, activated sludge and trickling filter plants. Advanced treatment processes considered in this collection are: solids removal by coagulation and sedimentation; filtration through sand or graded media; ammonia stripping, granular carbon adsorption; electrodialysis, microstraining of secondary effluent; aeration of secondary effluent; chlorination of secondary effluent; and pipelines for ultimate disposal. Also, added are construction costs for individual equipment, structures and consumable items. Costs are normalized to June 1967 and are presented as national averages to allow adjustment of these figures to reflect current cost indices and local situations. This is not a complete consideration of the subject, but is a compilation of a very large amount of data in one document and in a form suitable for use by those in the wastewater treatment field. (Goessling-Texas)
W72-04298

PILOT TREATMENT OF INDUSTRIAL-MUNICIPAL WASTES AT DEEPWATER, NEW JERSEY,
Delaware River Basin Commission, Trenton, N.J.
Ralph Porges.
Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 20, No 5, October 1971. 14 p, 4 fig, 1 tab, 3 ref.

Descriptors: *Municipal wastes, *Industrial wastes, *Pilot plants, *Activated sludge, Activated carbon, Aeration, Adsorption, Equalization, Neutralization, Sedimentation, Chlorination, Color, Biochemical oxygen demand, Dewatering, Sludge, Costs, Waste water treatment, New Jersey, *Regions, *Treatment facilities.
Identifiers: Deepwater (N.J.).

The Deepwater Region of New Jersey has been looked upon as an acceptable area for regionalized wastewater treatment facilities. An estimated $1 million pilot plant study of the composited wastes from the industries and the municipalities in the area was suggested and greeted with enthusiasm by the industries involved. The expenses of the pilot plant were defrayed by a 3-year Federal

Water Quality Administration grant of $646,700, $75,000 from the Delaware River Basin Commission, and $656,300 from the industries and municipalities. Wastes were collected by tank truck from each industry and composited on a volume basis proportional to flow at the pilot plant. The pilot plant was designed to provide storage, equalization, neutralization, primary clarification, aeration, secondary clarification and chlorination. In addition, ancillary processes previously and currently being evaluated include carbon adsorption, aerobic sludge digestion, sludge dewatering, and various other physical-chemical treatment methods. 90% BOD removal was achieved by the activated sludge plant but persistent color was removed only by activated carbon adsorption (97 %BOD and 93% color removals). (Lowry-Texas)
W72-04299

BENTHAL OXYGEN DEMANDS AND LEACHING RATES OF TREATED SLUDGES,
James A. Mueller, and Walter Jin-lungSu.
Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 18, No 4, October 6, 1971. 15 p, 15 fig, 8 tab, 13 ref.

Descriptors: *Benthos, *Oxygen demand, *Activated sludge, *Oxidation, Aerobic conditions, Anaerobic conditions, Diffusion, Leaching, Sludge digestion, Heat treatment, Water quality control, Waste water treatment, *Sludge treatment.
Identifiers: *Ocean disposal, *Wet oxidation.

Laboratory tests have demonstrated that the benthal oxygen demands and nutrient leaching rates can be significantly reduced by the treatment of the sludge before disposal at sea. Benthal oxygen demand reductions of about 50% were obtained by either heat treatment, low pressure wet oxidation, or digestion, and reductions in excess of 90% were obtained by intermediate and high pressure wet oxidation of the sludge. Anaerobic decomposition in the lower sludge layers significantly increased the benthal oxygen demands of the raw, digested, heat treated, and low wet oxidized sludges, while only negligible anaerobic decomposition occurred in the lower sludge layers of the intermediate and high wet oxidized sludges during the 45 day study. The major sludge benthal oxygen demand was shown to be due to diffusion of oxygen into the sludges where it was utilized in the aerobic surface sludge layers, with only a small portion of the demand attributable to oxidation of leached substances in the supernatant. For the same degree of volatile solids reduction, the wet oxidation process was demonstrated to be more efficient than sludge digestion in reducing benthal oxygen demand. (Lowry-Texas)
W72-04300

FATE OF ALUMINUM-PRECIPITATED PHOSPHORUS IN ACTIVATED SLUDGE AND ANAEROBIC DIGESTION,
Missouri Univ., Rolla. Dept. of Civil Engineering.
S. G. Grigoropoulos, R. C. Vedder, and D. W. Max.
Journal Water Pollution Control Federation, Vol 43, No 12, December 1971. p 2366-2382, 11 fig, 2 tab, 19 ref.

Descriptors: *Waste water treatment, *Phosphorus, Nutrient requirements, Chemical precipitation, Aluminum, *Activated sludge, *Anaerobic digestion, Efficiency, Effluents, Tertiary treatment.

The removal of phosphorus from wastewater is an essential step in reducing the nutrient enrichment of receiving waters. Phosphorus removal is technically feasible by biological or chemical means and can be accomplished during primary, secondary or tertiary treatment. Due to minimal additional equipment requirements, chemical precipitation in the activated sludge aeration chamber needs little financial investment and can be easily implemented in existing plants. Alum and sodium aluminate have been found to be effective in removing high percentages of influent phosphorus. A study has been conducted in the lab and in the field to determine the fate of precipitated phosphorus in the overall waste treatment process. Laboratory studies using continuous flow activated sludge units were dosed with various quantities of alum or sodium aluminate to determine optimum dose rates and removal efficiency. Field studies were conducted to verify the lab results and to produce waste sludge for digestion studies. The results indicate that: (1) alum and sodium aluminate were capable of precipitating phosphorus depending upon the influent concentration and the dose rate; (2) aluminum to phosphorus ratios of 1.3 and 1.9 were found optimum for alum and sodium aluminate respectively; (3) the added chemicals did not adversely affect treatment efficiency; (4) the amount of sludge greatly increased and the volatile fraction decreased when the chemicals were added; (5) these chemicals did not degrade anaerobic digestion and the aluminum remained in the sludge. (Goessling-Texas)
W72-04301

CHARACTERISTICS OF SEPARATED STORM AND COMBINED SEWER FLOWS,
Weston (Roy F.), Inc., Roslyn, N.Y.
John A. DeFlippi, and C. S. Shih.
Journal Water Pollution Control Federation, Vol 43, No 10, October 1971. p 2033-2058, 20 fig, 4 tab, 3 ref.

Descriptors: *Storm drains, *Storm runoff, Flow rates, Sampling, Monitoring, Analytical techniques, Biochemical oxygen demand, Chemical oxygen demand, Microorganisms, Organic loading, Nutrients, Rainfall intensity, Water pollution control, *District of Columbia.
Identifiers: *Combined sewers, *Rainfall durations, Total solids, Suspended solids.

Separated and combined sewers in the District of Columbia were sampled at 5 minute intervals during rainfalls. Total flows were measured with a lithium chloride tracer solution, and all samples were analyzed for BOD, COD, settleable solids, total solids, suspended solids, volatile suspended solids, lithium, total coliform, fecal streptococci, total phosphate, total nitrogen, and other nutrients. Results indicated that pollution concentrations in combined sewers during short storms are independent of rain-fall intensity but increase with discharge rate during the initial flushing period. Pollutant concentrations were high and remained so during short storms but dropped after the initial flushing period for long storms. Organic and nutrient concentrations in separated storm sewers were one-third those of combined sewers. The total waste loads were proportional to the length of dry weather between storms. Bacteriological counts varied with flow rates and peaked in the initial flushing period. (Lowry-Texas)
W72-04302

COLDWATER CREEK WASTEWATER TREATMENT PLANT,
Metropolitan St. Louis Sewer District, Mo. Coldwater Creek Wastewater Treatment Plant.
J. W. Larson.
Water and Wastes Engineering, Vol 7, No 4, April 1970. p 44-48, 3 fig, 3 tab.

Descriptors: *Activated sludge, *Waste water treatment, Settling basin, Aeration, Chlorination, Digester, Pumps, Missouri, Design criteria, Effluent, Piping system, Clay pipe, *Treatment facilities.
Identifiers: *Coldwater Creek (Mo), *Comminution, *St. Louis, Suspended solids, Grit basins, Diffusers.

The Coldwater Creek Wastewater Treatment Plant is designed to serve the wastewater treatment requirements of a 28,700 acre watershed which drains naturally to the Missouri River. Because of the area's rapid growth and because Coldwater Creek is dry most of the year, the area adjacent to the plant and downstream requires discharge of a high quality effluent. Treatment consists of grit removal followed by communition, primary settling, aeration, final settling, and chlorination before the effluent is discharged into Coldwater Creek. Primary and waste-activated sludge, sometimes thickened, is pumped into digesters. The digested sludge is disposed of in open sludge storage basins. When necessary, digester supernatant can be returned to the raw sewage flow or to the aeration basins in order to increase the solids loading. Because of a unique design feature, the entire flow of the main sewer can pass through the primary settling basins without any bypassing except in dire emergency. Even at maximum flow and minimum detention time, the amount of solids removal in the basins is approximately 35 percent. This is about two thirds of the removal at nominal design rating. Digested sludge is disposed of in four storage basins or lagoons on the east edge of the plant site which cover roughly 25 acres, including 15 ft. high berms. The disposal of the well-digested sludge has been without any odor nuisance. Level control is provided by gravity-decanting excess sludge liquor back to the plant influent sewer. (Biggs-Texas)
W72-04303

DESIGN AND OPERATION OF DISSOLVED--GAS FLOTATION EQUIPMENT FOR THE TREATMENT OF OILFIELD PRODUCED BRINES,
Shell Oil Co., Houston, Tex.
M. C. Sport.
Journal of Petroleum Technology, Vol 22, August 1970. p 918-920, 3 fig.

Descriptors: *Waste water treatment, *Oily water, Oil wastes, Oil industry, Economics, Pilot plants, On-site tests, Data collection, *Separation techniques, *Flotation.
Identifiers: *Dissolved-gas flotation equipment.

To minimize the possibility of polluting State of Federal waters in the Gulf Coast area, Shell Oil Company is currently using dissolved-gas flotation as a method of treating oilfield brine to remove residual oil prior to disposal. Two methods of gas flotation that have been used most successfully in treating wastewater are vacuum flotation and pressure flotation. Because of the higher hydraulic loadings obtainable with the injection of gas at elevated pressures, dissolved gas flotation reduces the size of facilities otherwise required to obtain water of acceptable quality for disposal. Currently Shell has six dissolved-gas flotation systems with a total capacity of 250,000 BWPD operating in the Gulf of Mexico. Five more systems to provide treatment for an additional 200,000 BWPD are being installed at both onshore and offshore locations. Twelve additional systems are in the planning stage for installation in the immediate future to treat an estimated 365,000 BWPD. Although flotation is not applicable in all circumstances, it will in many cases provide both economical and dependable separation. (Goessling-Texas)
W72-04304

RE-USE FACILITY REHABILITATION,
Dow Chemical Co., Dalton, Ga.
James B. Kaye.
Journal of the American Water Works Association, Vol 63, No 10, October 1971. p 641-643, 12 fig.

Descriptors: *Synthetic rubber, *Industrial wastes, *Coagulation, *Sedimentation, *Water reuse, Desilting, Dredging, *Waste water treatment, *Treatment facilities, *Rehabilitation.
Identifiers: *Suspended solids, Alum, Styrene, Butadiene.

The Dow Chemical Company's Dalton, Georgia plant uses alum coagulation and sedimentation to

remove synthetic rubber particles from process, coolant, and wash waters used in the manufacture of styrene-butadiene latexes. After clarification, the water is collected in a 9 million gallon reservoir for subsequent re-use and for fire protection. The system includes collection trenches, and primary settling ponds as well as the reservoir. After 4 1/2 years of continuous operation, the flocculated rubber settlings began to limit seriously the capacity of the three settling ponds and a fourth pond was constructed to be used while cleaning the other ponds one at a time. The Mudcat, a pontoon mounted dredge with an augur cutting device that feeds slurried settlings to the suction of a diesel-driven trash pump, was offered for use. A hydraulic boom on the Mudcat adjusts to cutting layers as deep as 10 1/2 feet below the water surface. Operation was successful and two of the ponds were cleared, restoring the original capacity. Dow hopes to operate another 5 years before the 3 active primary ponds will have to be cleaned. (Lowry-Texas)
W72-04307

A SURVEY OF HOUSEHOLD WASTE TREATMENT SYSTEMS,
General Dynamics Corp., Groton, Conn. Electric Boat Div.
J. Bailey, and H. Wallman.
Journal Water Pollution Control Federation, Vol 43, No 12, Dec 1971, p 2349-2360. 3 fig, 4 tab, 15 ref.

Descriptors: *Waste water treatment, Septic tanks, Cesspools, Anaerobic, Soil disposal fields, Aerobic treatment, Efficiencies, Costs, Economics, Domestic wastes.
Identifiers: *Household waste treatment units, Spiral bio-filter.

Approximately one-third of the 60 million individual housing units in this country depend on individual home treatment systems for wastewater disposal. Altogether, these units serve some 74 million people. Individual treatment systems can be found nearly everywhere. The home built decades ago in the country where cesspools or septic tanks were the norm suddenly find that the city has grown up around them. New subdivisions constructed beyond economic extension of the municipal sewer system, must turn to home treatment systems for sewage treatment. The conventional septic tank and newer variations are discussed and estimated treatment efficiencies are presented. Several types of aerobic treatment systems are now available for individual home use. These systems are described and the advantages as well as disadvantages are presented. The names and addresses of companies marketing aerobic treatment units are listed. Costs for purchase, installation and operation are estimated. This is a field that requires more research. The city cannot afford to provide sewers to everyone in the surrounding territory and as water quality requirements become more demanding, home treatment units must be able to comply. This should be the effort of an interdisciplinary team to permit a detailed survey of other fields for technology and processes to help meet the requirements of the future. (Goessling-Texas)
W72-04308

ENZYMATIC PATTERNS IN TWO DENITRIFYING MICROBIAL POPULATIONS,
National Inst. for Water Research, Pretoria (South Africa).
P. J. DuToit, D. F. Toerien, and T. R. Davies.
Water Research, Vol 4, 1970, p 149-156. 1 fig, 4 tab, 23 ref.

Descriptors: *Waste water treatment, *Denitrification, Water reuse, *Nitrogen, Phosphorus, Carbon, *Sewage bacteria, Sewage, Algae, Hydrogen ion concentration, Carbon dioxide, Nitrates, Nitrites, *Enzymes.
Identifiers: *Glucose, *Malate, Citric acid cycle, Cytochromes, Phosphorylation, Clycolysis.

In view of the increased attention given to denitrification as a process in wastewater renovation, it was necessary also to study the microbiology and biochemistry of the microbial populations active in this process. The denitrifying bacteria were obtained from a laboratory-scale, denitrifying unit receiving the supernatant fluid of settled domestic sewage. To ensure that an actively denitrifying population would be used, the original population was enriched in a suitable medium. Glucose and malate were degraded by the enriched denitrifying cultures with an accompanying decrease in nitrate content. Nitrate accumulated towards the end of the experiment but concentrations were low compared to the amount of nitrate removed in both cultures. Both cultures were started from a small inoculum of only 1 ml in 6.1. Within 36 hours the cultures were turbid and growth was pronounced after 80 hours at 30 deg C. Conclusions were: (1) denitrification took place with either glucose or malate as the source of carbon, (2) the intermediary metabolic patterns of the two cultures were different, (3) glucose degradation occurred via glycolysis, the pentose phosphate shunt and the citric acid cycle, (4) degradation of malate occurred mainly through the citric acid cycle, (5) cytochromes were more abundant in the malate cultures than in the glucose culture. Substrate phosphorylations as well as oxidative phosphorylation appeared to occur in the glucose culture, but only oxidative phosphorylation was detected in the malate cultures. (Biggs-Texas)
W72-04309

STRUCTURE OF EXOCELLULAR POLYMERS AND THEIR RELATIONSHIP TO BACTERIAL FLOCCULATION,
Ohio State Univ., Columbus. Microbial and Cellular Biology.
B. A. Friedman, P. R. Dugan, R. M. Pfister, and C. C. Remses.
Journal of Bacteriology, Vol 98, No 6, June 1969, p 1328-1334. 13 fig, 23 ref.

Descriptors: *Bacteria, Laboratory tests, Isolation, Microscopy, *Electron microscopy, *Flocculation, Waste water treatment.
Identifiers: *Flocculent growth habit, *Fibrils, Exocellular polymers, Polyelectrolytes.

Several gram-negative, polarly flaggellated rods were isolated on the basis of their flocculent growth habit. Some of the isolates possessed a capsular matrix which is composed of exocellular fibrils. Other isolates did not appear to have a capsular matrix when examined with a bright field microscope with or without the aid of strains. However, these latter type isolates did possess exocellular material which can be demonstrated by adsorption of a fluorescent dye under an ultraviolet microscope. Electron microscopic examination demonstrated that the exocellular material around all isolates examined is fibrillar. The fibrils were susceptible to cellulase although all fibrils did not appear to be identical. The data suggest that bacteria which have been isolated on the basis of their characteristic flocculent growth habit all possess exocellular fibrillar polymers. It is postulated that the exocellular polymers were responsible for the flocculent growth habit of the bacteria, and that the process of bacterial flocculation produced by synthetic polyelectrolytes was essentially the same as that caused by naturally produced exopolymers. (Goessling-Texas)
W72-04310

WASTEWATER REDUCTIONS IN METAL FINISHING OPERATIONS,
Northeastern Univ., Boston, Mass. Dept. of Civil Engineering.
William R. Domey, and Robert C. Stiefel.
Journal Water Pollution Control Federation, Vol 43, No 12, December 1971, p 2441-2447. 12 fig, 5 ref.

Descriptors: *Industrial wastes, *Heavy metals, *Acids, Cyanides, Separation techniques, Ions, Baffles, Conductivity, Water reuse, Water pollution control, *Waste water treatment, Massachusetts.
Identifiers: *Metal finishing wastes, *Plating wastes, *Flow reduction, Rinse waters, Counterflow rinsing.

The limited size of the physical plants, limited number of employees available, and economic conditions of the metal finishing operations in Massachusetts necessitated development of a waste treatment scheme that: (1) was minimal in size, (2) was simple and economical to operate; and (3) was dependable and safe to use. Wastewater flow rates for the various companies ranged from 1000 to 100,000 gpd. and consisted mainly of rinse waters containing heavy metals, acids, and cyanides. A preliminary step to treatment of the wastes was flow reduction to reduce treatment costs. Counterflow rinsing techniques as well as the application of water reuse and conductivity were instituted for this purpose. Waste flows were reduced by as much as 90%, and consequently it was possible to design small batch-type treatment systems for these and other similar firms lacking both available space and capital for pollution abatement operations. (Lowry-Texas)
W72-04311

GET THE LEAD OUT, METHODS FOR REMOVING LEAD FROM PLANT WASTE WATER STREAMS,
Sunflower Army Ammunition Plant, Lawrence, Kans.
M. A. Kozak, R. J. Baczuk, and G. K. Landram.
Available from the National Technical Information Service as AD 729049, $3.00 in paper copy, $0.95 in microfiche. Sunflower Army Ammunition Plant Report No SUN 143-10, August 2, 1971, 72 p. 15 fig, 7 tab, 8 ref.

Descriptors: *Industrial wastes, *Heavy metals, Toxicity, *Chemical precipitation, Lime, *Ion exchange, Resins, Adsorption, *Separation techniques, Pilot plants, Feasibility studies, Analytical techniques, *Waste water treatment, Kansas.
Identifiers: *Lead, *Nitroglycerin.

Two approaches to the problem of lead removal from the effluent of the Sunflower Army Ammunition Plant were taken. Pilot plant studies were conducted on both the chemical precipitation method and the ion exchange process. An ion exchange process was developed with the capability of reducing lead concentrations to well below the 0.05 ppm limit. The process functioned well in the presence of normal 'hard water' metal ions, and also thoroughly removed NC and 2-NDPA from the effluent streams, while remaining unaffected by dissolved nitroglycerin. Two preliminary plant designs, complete with cost estimates, were formulated for the ion exchange method from the accumulated data. In the second method, lime and ferric salts (ferric chloride and ferric sulfate) were used to treat blender wastewater. Lead removals of 75-85% were achieved, reducing lead levels to as low as 0.30 ppm. Overall improvement in water quality was also realized with this system. Based on the pilot plant results, the decision was made to design a combination of the two systems, rather than to use either one separately. The bulk of the lead removal was to be accomplished by the precipitation method, with the ion exchange system to be used as a polishing step. No full scale operating cost projections were presented. (Lowry-Texas)
W72-04312

DESIGN OF WASTEWATER DISPOSAL SYSTEMS FOR INDIVIDUAL DWELLINGS,
Environmental Health Service, College, Alaska.
Leroy C. Reid, Jr.
Journal Water Pollution Control Federation, Vol 43, No 10, October 1971, p 2004-2010. 4 fig, 2 tab, 7 ref.

Descriptors: *Waste water treatment, *Design criteria, *Laboratory tests, *Aeration, Sedimentation, Disinfection, Chlorination, Sludge, Odors, Cost analysis, Electric power costs, Operation and maintenance, *Waste water disposal, Biochemical oxygen demand, Domestic wastes, Water reuse.
Identifiers: *Suspended solids.

The Aqua-reuse wastewater treatment system was developed for use in single-unit dwellings. The unit operates as an extended aeration system, with four separate operations: primary aeration, secondary aeration, or agglomaration, sedimentation, and chlorination. These functions are accomplished primarily through the use of primary and secondary aeration chambers controlled by the use of an airlift system, plate settlers, and a chlorine contact chamber. A laboratory study produced information on performance of the plate settlers and of the unit as a whole, and from this information, a full scale 300 gpd plant was constructed. This plant was operated for 5 months with average BOD and suspended solids removal efficiencies of 96%. Another advantage of the system was increased life of the drainfield, due to the low suspended solids content. Sludge disposal is required semi-annually. The unit may be buried in the ground or installed in the basement. Airtight construction ensures no odor problems. Depending on geographic location in the U.S., power costs will range from $0.04 to $0.12/day ($14.80 - $43.80/year). (Lowry-Texas)
W72-04313

TREATMENT OF COLD-MILL WASTEWATER BY ULTRA-HIGH-RATE FILTRATION,
Bethlehem Steel Corp., Pa. Homer Research Lab.
C. R. Symons.
Journal Water Pollution Control Federation, Vol 43, No 11, November 1971, p 2280-2286. 6 fig, 1 tab.

Descriptors: *Industrial wastes, *Oil wastes, *Emulsions, Coagulation, Flotation, Skimming, *Filtration, Diatomaceous earth, Pilot plants, Hydrogen ion concentration, Alkalinity, Stream, *Waste water treatment.
Identifiers: *Suspended solids, Backwashing, *Steel industry.

Wastewater from cold reduction rolling mills contains both floating and emulsified oils in concentrations up to 700 mg/l, and suspended solids up to 250 mg/l. Floating oils are readily removed by skimming, leaving approximately 230 mg/l of emulsified oils in the effluent. To meet the standards of 15 mg/l of oil and 40 mg/l of suspended solids established by New York State as the maximum permissible concentrations in industrial effluents discharged to boundary waters, several treatment schemes were evaluated. These systems included: (1) acid chemical treatment with cold lime neutralization; (2) solvent extraction in an electrofining precipitator; (3) alkaline chemical treatment followed by dissolved air flotation; (4) UHR filtration alone or in combination with filtration through diatomaceous earth; and, (5) diatomaceous-earth (DE) filtration in a pressure pre-coat filter. Pilot scale tests demonstrated that UHR filtration was the most feasible of the methods tested. UHR filtration produced effluents containing less than 20 mg/l oil and 30 mg/l suspended solids. The addition of a polyelectrolyte coagulant aid to the water as it left the skimmer tank further reduced oil and solids to less than 15 and 20 mg/l respectively. The use of steam during backwashing prevented the buildup of oil on the filter media. The backwash volume was 5% of the water filtered. (Lowry-Texas)
W72-04314

SPRAY IRRIGATION SYSTEM FOR TREATMENT OF CANNERY WASTES,
Campbell Soup Co., Camden, N.J.
L. C. Gilde, A. S. Kester, J. P. Law, C. H. Neeley, and D. M. Parmelee.
Journal Water Pollution Control Federation, Vol 43, No 10, October 1971, p 2011-2025. 5 fig, 5 tab, 7 ref.

Descriptors: *Canneries, *Industrial wastes, *Tertiary treatment, Irrigation, Adsorption, Evaporation, Evapotranspiration, Runoff, Permeability, Phosphates, Nitrates, Land reclamation, *Soil conservation, Water quality control, *Waste water treatment, *Water reuse, Soils, Ohio, Texas, *Irrigation systems.
Identifiers: Napoleon (Ohio), Paris (Texas), *Spray irrigation.

Cannery waste volumes of up to 3.6 mgd have been subjected to overland flow treatment on impervious soils for 5 years. Eroded cotton farms were reconditioned to uniform slopes and terraces for treatment purposes. The system has averaged 99% BOD removal and is capable of removing 90% of the applied nitrates and phosphates. Water balance measurements accounted for 93% of the applied water, showing 18% as evaporative losses, 61% as runoff, and 21% as percolating through the soil. Hay was grown and harvested from the disposal site, and was found to be superior in quality and preferred by cattle over other local grasses. Analyses demonstrated that nitrogen and phosphorus contents were nearly double those of average hay crops, and crude protein content ranged up to 23%. Quantitative and qualitative studies of the microbial flora in the soil were also carried out, revealing an average microorganism population 6 times that of normal soils. The system consistently equaled or bettered tertiary treatment by other methods while also representing an excellent soil conservation practice. (Lowry-Texas)
W72-04315

THERE ARE SOME ANSWERS TO TEXTILE POLLUTION,
Warnaco, Inc., Ashaway, R.I.
Harold J. Northup.
Textile Chemist and Colorist, Vol 2, No 15, July 29, 1970, p 255-261. 8 fig, 5 tab, 23 ref.

Descriptors: *Textiles, *Industrial wastes, *Waste water treatment, Pulp wastes, Biodegradation, Lagoons, Trickling filters, Sedimentation, Aeration, Odors, Dissolved oxygen, Alkalinity, Hydrogen ion concentration, Color, Nutrients, Activated carbon, Water pollution control, Biochemical oxygen demand.
Identifiers: *Equalization, *Dye wastes.

The main problems confronting most textile plants, with regard to waste treatment, are organic wastes, alkalinity, and nutrients, as well as aesthetic effects. Companies have reacted in all extremes to the problem, from completely ignoring the problem until forced to act, to over-reacting to the point of over-extending, and ultimately failure. A survey of 15 major textile producers revealed that eight of them were obtaining BOD reductions in excess of 95%, three were obtaining BOD reductions of 90% or more, and two were obtaining reductions in excess of 85%. The various treatment methods used by the manufacturers included: (1) bioaeration without primary settling and sludge digestion, with settling of the effluent and sludge recycle; (2) oxidation ponding; (3) mechanical aeration; and, (4) chemical precipitation. Other processes for use in specific cases included reduction of waste liquid volume, through conservation and reuse, reduction of process chemicals, recovery and reuse of chemicals, process modifications, good housekeeping, and substitution of chemicals. The trend today is to encourage the use of biodegradable substances wherever possible in the manufacture and treatment of textiles. The Ruhr River is cited as an example of pollution control that has safeguarded the purity of a river receiving municipal and industrial wastes from an equivalent population of 3 million people. Problems posed by various types of wastes, and disposal methods are discussed and evaluated. (Lowry-Texas)
W72-04316

PERSPECTIVES ON WASTEWATER TREATMENT PROCESSES--PHYSICAL-CHEMICAL AND BIOLOGICAL,
Environmental Protection Agency, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.
Edwin F. Barth.
Journal Water Pollution Control Federation, Vol 43, No 11, November 1971, p 2189-2194. 1 fig, 5 tab, 2 ref.

Descriptors: *Waste water treatment, *Optimization, *Operations research, Industrial wastes, Municipal wastes, Research and development, Biodegradation, Tertiary treatment, Design criteria, Planning, Water quality control.
Identifiers: *Individual design, Discharge requirements.

Several years of observation of biological treatment processes and physical-chemical treatment processes have prompted the judgement that physical-chemical treatment processes will not replace biological treatment but complement it. Advanced methods are expected to add new dimensions to the capacity to treat wastes of all kinds. An example of the development of nitrogen removal and control is presented. Nitrogen removal processes are capable of producing a completely nitrogen free effluent. However, the requirements of each situation are different, and in many cases only a nitrified effluent is required for discharge. It becomes obvious through this and other examples that the real objective in wastewater treatment is intelligent unit process selection to obtain optimum systems of treatment to meet the individual and varied requirements for effluent discharge. (Lowry-Texas)
W72-04317

TREATMENT OF WASTES FROM A SOLE LEATHER TANNERY,
Cincinnati Univ., Ohio.
J. David Eye, and Lawrence Liu.
Journal Water Pollution Control Federation, Vol 43, No 11, November 1971, p 2291-2303. 10 fig, 1 tab, 12 ref.

Descriptors: *Industrial wastes, *Oxidation lagoons, *Chemical precipitation, Lime, Coagulation, Biochemical oxygen demand, Odors, Disinfection, Chlorination, Foaming, Cost analysis, *Waste water treatment.
Identifiers: *Tanneries, *Hides, Suspended solids.

Pilot plant and full-scale treatment studies extending over a 3 year period were conducted in an attempt to develop a feasible waste treatment procedure for tannery wastes. Waste characterization studies revealed that about 70% of the total pollutional load discharged initially was contained in 3 or 4 waste streams comprising only 30% of the total volume of wastes discharged. A waste reduction program was instituted, including conservation, reuse, and process changes. The remaining liquid wastes were segregated and pretreated at pont of origin. In a full scale system, 10 mg/l of anionic polyelectrolyte gave optimum removal (about 90%) of suspended lime particles, while BOD reductions of the other wastes in biological treatment lagoons were 70 to 90%. Odors arising from treatment of beamhouse wastes were controlled by addition of tan liquors, but a decrease in BOD reduction efficiency also resulted. Foaming problems were partly controlled by high pressure jets and disinfection was achieved with 30 mg/l chlorine. Capital cost was $40,000, and operating costs were reported as $15,000/year for the 800 hide/day tannery's treatment system. (Lowry-Texas)
W72-04319

USE OF POLYELECTROLYTES IN TREATMENT OF COMBINED MEAT-PACKING AND DOMESTIC WASTES,
South St. Paul Wastewater Treatment Plant, Minn.
K. D. Larson, R. E. Crowe, D. A. Maulwurf, and J. L. Witherow.

Journal Water Pollution Control Federation Vol 43, No 11, November 1971, p 2218-2228. 8 fig, 7 tab.

Descriptors: *Industrial wastes, *Coagulation, *Laboratory tests, Municipal wastes, Separation techniques, Flocculation, Sedimentation, Chemical precipitation, Feasibility studies, Cost analysis, Labor, Electric power costs, Construction costs, *Waste water treatment, Domestic wastes.
Identifiers: *Meat packing wastes, *Ferric chloride, *Polyelectrolytes, Suspended solids, Joint treatment.

Jar tests of numerous coagulants were conducted at the South St. Paul Wastewater Treatment Plant to select chemicals for full scale testing. Influent to the plant consisted of 90% meat packing waste and 10% municipal waste, which was treated by trickling filter, and subjected to anaerobic stabilization in a stabilization pond. A dual system of ferric chloride followed by the addition of a high-molecular-weight polymer was demonstrated to be the most effective in reducing suspended solids, and thereby reducing the overload on the filter. The system decreased SS concentrations by 100 mg/l and BOD concentrations by 140 mg/l, leaving effluent concentrations of 120 mg/l and 540 mg/l respectively. Primary flocculation by the ferric chloride produced a small voluminous floc that was further increased in size by the secondary flocculation of the organic polyelectrolyte producing a settleable precipitate. Full scale application costs of the dual chemical system of approximately $0.045/1000 gallons of waste treated were divided as: (1) 71% chemicals; (2) 15% construction; (3) 12% labor; and (4) 2% for utilities. These costs are in addition to the normal operating costs of the existing facilities. (Lowry-Texas)
W72-04322

SLUDGE DIGESTION PRACTICES ON OAHU, HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
Jeong-rong Chen, and Reginald H. F. Young.
Technical Report No. 52, September 1971. 20 p, 7 fig, 5 tab, 27 ref.

Descriptors: *Anaerobic digestion, Biological treatment, *Sludge digestion, Organic loading, *Sludge treatment, Aerobic treatment, *Waste water treatment, *Hawaii, Filtration, Activated sludge, *Treatment facilities, Efficiencies.
Identifiers: Oahu (Hawaii).

Characteristics and treatment efficiency of the sludge digestion facilities at four sewage treatment plants of the City and County of Honolulu, one each at Kaneohe, Kailua (both secondary treatment-trickling filter plants), and Pearl City (primary treatment), which utilize anaerobic digestion systems and the fourth at Mililani (secondary treatment-activated sludge), which utilizes an aerobic digestion system were studied over a two-week period at each plant. Included in the study were both raw and digested sludges. Overall results indicate that the digestion systems were operating generally within accepted ranges for parameters tested. The Kaneohe plant had a volatile solids reduction of 64 percent, solids retention time of 143 days, and methane: carbon dioxide gas yield percentage of 67:33. The Kailua plant had a volatile solids reduction of 30 percent, solids retention time of 32 days, and methane: carbon dioxide gas yield percentage of 66:34. The Pearl City plant had a volatile solids reduction of 64 percent, solids retention time of 10 days and methane: carbon dioxide gas yield percentage of 64:36. The Mililani plant had a volatile solids reduction of 49 percent with a sludge age of 36 days. It was concluded that the three anaerobic digestion systems were operating satisfactorily although not at optimum efficiency.
W72-04350

SLUDGE DISPOSAL BY PRESSING,
Fylde Water Board, Blackpool, (England).
For primary bibliographic entry see Field 05F.
W72-04402

SLUDGE CONDITIONING BY POLYELECTROLYTES,
Fylde Water Board, Blackpool, (England).
For primary bibliographic entry see Field 05F.
W72-04403

CARTER AUTOMATIC BELT-FILTER PRESS.
Carter (Ralph B.) Co., Hackensack, N.J.

Technical Publication, 4 p, 5 fig, 2 tab.

Descriptors: *Dewatering, Sludge treatment, Operation, Costs, *Waste water treatment, Industrial wastes, Municipal wastes, Filters.
Identifiers: *Filter press, Pressure filtration, Polymers.

The design principles and general operation of a filter press to dewater municipal and industrial wastes are described. The filter media is a multi-composition coarse mesh fabric. Polymers bridge the solid particles and accelerate dewatering in a pretreatment sequence. The pressure for filtration is adjustable. Maximum pressure should be the point where sludge cake is retained on the filter belt and floc particles are not broken. Destroyed floc particles can pass the fabric or clog the filtration media. Equations describe dewatering in the drainage, press, and shear zone. Industrial sludges and twenty municipal sludges were dewatered by filter press in Germany. Data are tabulated for raw sludges, primary digested sludges, and mixed digested sludges from primary and secondary sewage treatment. These data include: sludge and presscake moisture content; water removed; sludge and dry solids throughput; flocculant cost; power consumption; attendance time; and total operating cost. In England, data were tabulated for domestic and industrial waste, including pharmaceutical and brewery waste. Limited cost data compare filter pressing to sand bed drying and vacuum filtration of specific wastes. (Nardozzi-AWWA)
W72-04404

THE DISPOSAL OF WASHWATER SLUDGE BY FREEZING,
Fylde Water Board, Blackpool (England).
For primary bibliographic entry see Field 05F.
W72-04405

THE DISPOSAL OF SLUDGE BY THE FREEZING AND THAWING PROCESS,
Fylde Water Board, Blackpool (England).
For primary bibliographic entry see Field 05F.
W72-04406

SLUDGE DEWATERING BY FREEZING,
Environmental Protection Agency, Cincinnati, Ohio. Office of Water Programs.
For primary bibliographic entry see Field 05F.
W72-04407

DEWATERING OF WATER TREATMENT ALUM SLUDGE BY CENTRIFUGATION,
Penwalt Corp., Warminister, Pa.
For primary bibliographic entry see Field 05F.
W72-04408

OPERATIONAL AND EXPERIMENTAL EXPERIENCE AT DAER WATER TREATMENT WORKS, WITH SPECIAL REFERENCE TO THE USE OF ACTIVATED SILICA AND THE RECOVERY OF ALUM FROM SLUDGE,
Lanark County Water Dept. (Scotland).
For primary bibliographic entry see Field 05F.
W72-04409

THE ROLE OF POLYELECTROLYTES IN WATER AND WASTE TREATMENT,
Hercules, Inc., Wilmington, Del. Environmental Services Div.
For primary bibliographic entry see Field 05F.
W72-04411

FILTER PLANT INCLUDES WASTE TREATMENT,
Baker (Michael) Jr., Inc., Rochester, Pa.
For primary bibliographic entry see Field 05F.
W72-04412

THE DISPOSAL OF SLUDGE FROM WATER TREATMENT PLANTS,
Fylde Water Board, Blackpool (England).
For primary bibliographic entry see Field 05F.
W72-04413

SOME SOLUTIONS TO SLUDGE TREATMENT PROBLEMS AT FISHMOOR TREATMENT PLANT,
Fylde Water Board, Blackpool (England).
For primary bibliographic entry see Field 05F.
W72-04414

THE PROBLEM OF SLUDGE DISPOSAL AT THE ARNFIELD TREATMENT PLANT (MANCHESTER CORPORATION WATERWORKS),
Manchester Corp. (England). Waterworks Dept.
K. A. Sankey.
Journal of the Institution of Water Engineers, Vol. 21, No. 4, p 367-378, June 1967. 4 fig.

Descriptors: *Dewatering, Freezing, Costs, Filtration, *Sludge treatment, Waste treatment, Treatment facilities, *Sludge disposal.
Identifiers: *Filter pressing, Wedge-wire filtration, Rotary-vacuum filtration, Arnfield Treatment Plant (England).

Several sludge dewatering processes are systematically evaluated at the Arnfield Treatment Plant. Conclusions on optimum sludge concentration and hydraulic capacity, bed covering, draining and drying cycle, layering effects, mechanical cleaning, and design criteria are presented for wedge wire sludge filtration. Experimentation with a diatomaceous earth precoating of a rotary-vacuum filter on a lime conditioned sludge was promising. Preliminary determinations for filter pressing included the degree of preconditioning, effluent quality, cycle time, and cake disposal problems for this process. Conditioned sludges were more easily dewatered than untreated sludges. Hydrated lime was a good conditioner. Slow-stirring thickening did not enhance dewatering characteristics significantly. Capital and running costs are tabulated for wedge-wire and rotary-vacuum filtration, filter pressing, and freezing operations. Filter pressing appeared most economical. A discussion of system parameters including cake discharge, automation, downtime, and cloth life is presented for the filter press. The final design incorporated lime conditioning, provision for slow-stirring thickeners, and a semi-automatic press. The press supernatant will be recovered. (Nardozzi-AWWA)
W72-04416

WATER PLANT SLUDGE TREATMENT,
Havens and Emerson, Ltd., East Patterson, N.J.
For primary bibliographic entry see Field 05F.
W72-04417

SOLUBLE PHOSPHATE REMOVAL IN THE ACTIVATED SLUDGE PROCESS - A TWO YEAR PLANT SCALE STUDY,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
D. A. Long, J. B. Nesbitt, and R. R. Kountz.

Paper presented at the 26th Annual Purdue Industrial Wa,te Conference, May 4-6, 1971. 33 p, 9 fig, 4 tab, 12 ref. EPA Program 17010 EIP 05/71.

Descriptors: *Activated sludge, *Waste water treatment, *Phosphates, *Phosphorus, *Sludge, *Sludge digestion, Eutrophication, Nitrification, Nutrients, Chemical precipitation, Digestion.
Identifiers: *Aluminum salts.

Sludges containing aluminum phosphorus precipitates from an activated sludge wastewater treatment plant were digested in a high rate digester. Sodium aluminate and liquid alum were used to precipitate the phosphorus from the wastewater. Analyses on both raw and digested sludges showed that once precipitated from the wastewater and incorporated into a sludge the phosphorus did not redissolve while undergoing anaerobic digestion. Most of the soluble phosphorus in both the raw and digested sludges was in the orthophosphate form, and the addition of the inorganic aluminum phosphorus complexes did not adversely affect the anaerobic digester. High concentrations of soluble aluminum ion did not appear in the anaerobic digester, and the use of alum for phosphorus removal caused no additional hydrogen sulfide production during sludge digestion. Analyses also indicated the addition of aluminum compounds enhanced the dewatering properties of the raw sludges. (EPA abstract)
W72-04419

ECONOMIC AND INSTITUTIONAL ANALYSIS OF WASTEWATER RECLAMATION AND REUSE PROJECTS,
Leeds, Hill and Jewett, Inc., San Francisco, Calif.
H. O. Banks, A. J. Inerfield, C. G. Wolfe, D. L. Tucker, and P. G. Harris.
Available from NTIS, Springfield, Va. 22151 as PB-206 522, $3.00 in paper copy, $0.95 in microfiche. Report 14-31-0001-3177, December 1971. 171 p, 23 fig, 10 tab, 207 ref, append. OWRR C-1912 (No. 3177) (1).

Descriptors: *Water reuse, *Optimization, *Economic feasibility, *Institutional constraints, *Reclaimed water, Waste water treatment, *Cost allocation, Economics, Evaluation, California, Water supply, Potable water, Water quality, Waste disposal.
Identifiers: Contra Costa County (Calif), *Consumer costs.

Methodology was developed for selecting the optimum size, configuration, and timing of a wastewater reclamation project jointly undertaken by a waste disposal and water supply agency. The procedure is also applicable to reclamation projects undertaken by a single agency having both waste disposal and water supply functions. A separate procedure was developed for allocating project costs between disposal and supply functions, and, if the project includes recreation, to that function as well. The optimization and cost allocation procedures are most completely developed for reliable, direct use reclamation projects producing a non-potable supply. Guidelines are included for analyzing interruptible projects and those producing potable supplies. Suggestions are also included for suitable institutional arrangements which would be necessary for joint reclamation projects to operate efficiently. A basic consideration in the analysis of economic feasibility of wastewater reclamation projects must be an evaluation of the costs borne by consumers of inferior quality water. The report discusses this subject in depth and presents some representative consumer cost data. The report also discusses quantity and quality requirements for various uses of reclaimed water, and presents information on the methods, efficiencies, and typical costs of various reclamation processes. An extensive bibliography is included.
W72-04420

SOLID WASTES SCHEMES SIFTED,
J. H. Prescott, and J. E. Browning.
Chemical Engineering, Vol. 77, No. 11, May 18, 1970. p 80-82, 3 fig.

Descriptors: *Solid wastes, *Salvage value, *Waste disposal, Incineration, Landfills, Transportation, Economic feasibility, Technical feasibility.
Identifiers: *Recycling, *Pyrolysis, *Carbonization, *Hydrogenation.

At the 2nd Waste Utilization Symposium, held in Chicago, March 18-19, 1970, solid wastes were characterized as our only growing resource by Hollis M. Dole, U.S. Department of The Interior. Senator Caleb Boggs called solid wastes, 'America's largest industry,' at National Industrial Solid Waste Management Conference held in Houston, Texas on March 24-26, 1970. During these conferences methods of salvage and reclamation of usable materials from solid wastes were reviewed and discussed. Salvage was shown to be declining due to increased costs and failing markets. Pyrolysis, carbonization and hydrogenation were discussed and the possibilities of these processes to alleviate the solid waste crisis discussed. Some of these methods show promise but the overall tenor of the meetings was that little actual progress had been made on resolving the solid waste problem in an economical manner. The general feeling was that perhaps the problem was much more difficult than first anticipated. (Goessling-Texas)
W72-04422

ELIMINATING OR DISPOSING OF INDUSTRIAL SOLID WASTES,
Dow Chemical Co., Midland, Mich.
R. G. Novak.
Chemical Engineering, Vol. 77, No. 21, October 5, 1970. p 79-82, 4 fig.

Descriptors: *Solid wastes, *Waste disposal, *Industrial wastes, Chemical wastes, *Incineration, *Landfills, Management, Pollution abatement, Resources, Economics, Cost analysis, Michigan.
Identifiers: *Midland (Mich).

The solid wastes program at the Midland Division of the Dow Chemical Company places stress first on eliminating or reducing the solid wastes leaving the generating area, and second, on disposal of the remaining wastes in a manner that will not create immediate or long term pollution problems. The first part of this program is based on a company wide commitment to identify the most economical means of achieving zero wastes. Once fully accepted, this part of the solid wastes program will reduce the magnitude of the wastes to be treated by the second element of the program. The waste disposal section consists of five incinerators of varying capacities and capabilities backed up by a 200 acre sanitary landfill. The waste load is currently 650,000 gal/mo of liquid residues, 500 drums (55 gal)/mo. that contain miscellaneous liquid residues, and about 20,000 cu.yd./mo. of refuse for disposal. Liquid residues are stored by category in receiving tanks until they can be incinerated. These liquids are blended to provide optimum burning characteristics. Refuse is incinerated with drum quantities of tars. Refuse and other wastes that cannot be incinerated and the residues of incineration are landfilled on site. It is company policy that hazardous or unusual wastes be completely identified by the individual creating the wastes. These people are also required to participate in determining the disposal steps to be used. The solid wastes program is a growing and flexible one, and requires careful attention to short-range and long-range objective. (Goessling-Texas)
W72-04424

SOME NOTES ON REUSE,
Cornell, Howland, Hayes and Merryfield, Corvallis, Oreg.
L. G. Suhr.
American Water Works Association Journal, Vol 63, No 10, October 1971. p 630-633, 1 fig, 2 tab.

Descriptors: *Municipal wastes, *Water reuse, *Tertiary treatment, Industrial water, Recreation facilities, Activated sludge, Lime, Coagulation, Sedimentation, Adsorption, Activated carbon, Chlorination, Laboratory tests, Bacteria, Viruses, Groundwater recharge, Water quality control, *Waste water treatment, *Standards.
Identifiers: Dissolved solids, Windhoek (So. Africa).

Wastewater reclamation has been and is being successfully practiced at various locations in the world for various purposes. Installations in the United States are primarily concerned with providing sufficient treatment as to prevent further pollution of water supplies, to augment supplies of recreational water, and to provide groundwater barriers to salt water intrusion. In South Africa, however, water shortages have dictated that waste water reclamation be the least expensive method of supplying 1/3 of the municipal water to the City of Windhoek. Water at Windhoek, and at the U. S. installations consistently surpasses USPHS standards and WHO standards for drinking water quality. A system similar to the one at Windhoek is being planned for Daspoort, Pretoria, and the City of Denver, Colorado is planning a water re-use facility for initially industrial but eventually municipal water supply. It is obvious, therefore, that the technology exists for the total elimination of pollution, and the capability of supplying the entire world with pure water. What remains is to institute refinements to lower the cost and improve the tests and controls and education to increase the public acceptability of reclaimed water. (Lowry-Texas)
W72-04425

SINGLE-STAGE LIME CLARIFICATION OF SECONDARY EFFLUENT,
Robert A. Taft Water Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.
E. L. Berg, C. A. Brunner, and R. T. Williams.
Water and Wastes Engineering, Vol 7, No 3, March 1970. p 42-46, 7 fig, 1 tab, 6 ref.

Descriptors: *Effluent, *Lime, *Activated sludge, Turbidity, Chlorination, Flocculation, Filters, Sludge, Sedimentation, Hydrogen ion concentration, Absorption, Phosphates, Chemical precipitation, Alkalinity, *Waste water treatment.
Identifiers: *Lime clarification, *Suspended solids, Hydroxypatite.

The lime clarification system of phosphorus and suspended solids removal consists of a single-state upflow clarifier, two dual-media filters, storage tanks for backwash water and sludge, and sludge drying beds. The clarifier consists of three zones: (1) a primary reaction zone where rapid mixing of secondary effluent, lime slurry, and sludge occurs; (2) a secondary reaction zone which directs the flow down through the sludge blanket; (3) a sedimentation zone. Monthly averages of suspended solids concentrations for secondary and clarifier effluents for a one year period were 43.5 and 16.5 mg/l respectively, while the sludge removed from the clarifier averaged 2.8 percent solids. It was established that a clarifier effluent containing 16 mg/l could be obtained while operating at pH 9.5. Clarification at a pH of 9.5 also produced average phosphate concentrations of 2.3 and 1.7 mg/l for clarifier and filtered effluents, while the average phosphate concentrations at pH 10.7 were 1.5 and .36 mg/l. The cost for lime clarification of secondary effluent based upon a 100 mgd plant operating at pH 9.5 was estimated at 6.2 cents per 1000 gallons of product water. The cost estimate did not reflect sludge disposal costs, however, these figures were comparable to other forms of clarification. (Biggs-Texas)
W72-04426

THE CHANGING NATURE OF TEXTILE PROCESSING AND WASTE TREATMENT TECHNOLOGY,
Clemson Univ., S. C. Dept. of Textiles.

John J. Porter.
Textile Chemist and Colorist, Vol 2, No 19, September 23, 1970. p 330-333, 4 fig, 19 ref.

Descriptors: *Textiles, *Waste water treatment, *Industrial wastes, Flexibility, Municipal wastes, Planning, Biochemical oxygen demand, Biodegradation, Resins, Water quality control.
Identifiers: *Polymers, *Synthetic fibers.

The use of man-made fibers, polymers, and finishes by the textile industry is increasing at a rapid rate. With new developments in processes and materials has come an increasing resistance to degradation. Treatment schemes which were workable in the past, such as joint treatment of textile wastes with municipal wastes, are being outmoded by increasing inertness of the textile wastes. In the future, indications are that waste streams from different processing operations will have to be isolated and treated by either chemical or biological methods as a separate entity. This approach will allow industry more latitude in its choice of chemicals and processes, since the treatment scheme will be tailored to the particular effluent. Two important considerations for the construction of a waste treatment plant are the cost and availability of land. As waste chemicals become harder to degrade biologically, longer retention times will be needed for their degradation in the treatment plant. However, chemicals that are resistant to degradation may be removed from the stream by absorption on the sludge formed by biological degradation. In some cases this will be satisfactory, but more data is needed to substantiate the effectiveness of this method. In addition, tests have demonstrated the inadequacy of the standard BOD test for evaluating the pollutional load contained in non-biodegradable material. Total carbon analyses are therefore recommended as giving a more comprehensive assessment of the true situation. (Lowry-Texas)
W72-04427

PHYSICAL CONDITIONING OF ACTIVATED SLUDGE FLOC,
California Univ., Berkeley.
Denny S. Parker, Warren J. Kaufman, and David Jenkins.
Journal Water Pollution Control Federation, Vol 43, No 9, p 1817-1833, September 1971. 14 fig, 6 tab, 25 ref.

Descriptors: *Activated sludge, *Flocculation, *Mixing, *Sludge treatment, Particle size, Aeration, Turbulence, Design criteria, *Waste water treatment, California.
Identifiers: *Floc break-up, *Aggregation, Suspended solids, Clarification.

Activated sludge was obtained from an activated sludge plant at the Sanitary Engineering Research Laboratory at California University and subjected to laboratory scale investigations of the floc breakup. Aeration rates were controlled to approximate the turbulence conditions found in a typical full-scale plant. Four series of bioflocculation experiments were conducted to obtain data for sludges with a variety of loading rates and mean sludge ages. Analysis of optimum particle sizes and shearing rates demonstrated that activated sludge conditioning typically provided in activated sludge plants is not optimum for secondary clarification. Significant improvements in effluent clarity were obtained by inserting a mildly stirred flocculator immediately before secondary clarification, providing a favorable environment for aggregation and encouraging further incorporation of the dispersed solids into the floc at only a modest cost increase. Although pilot studies are desirable for specific sludges, it should be possible to use empirical coefficients presented to estimate plant performance. (Lowry-Texas)
W72-04429

NEW DIRECTIONS FOR WASTEWATER COLLECTION AND DISPOSAL,
North Carolina Univ., Chapel Hill.
Daniel A. Okun.
Journal Water Pollution Control Federation, Vol 43, No 11, p 2171-2180, November 1971. 19 ref.

Descriptors: *Municipal wastes, *Tertiary treatment, *Water reuse, Industrial water, Land reclamation, Irrigation, Analytical techniques, Cost analysis, Water quality control, Engineering education, Personnel, Research and development, Waste water treatment.

An increasing number of problems is developing in finding new applications for renovated wastewater. Most authorities in the United States agree that at the present stage of development, municipal wastewater treatment plant effluent can not be monitored and controlled closely enough to be considered a safe source of potable water. Considerable upgrading of virus and chemical detection and removal devices is necessary before such use is considered. However, reclaimed water has many applications in industrial, agricultural and recreational uses. Many projects are presently in operation which recycle treated municipal wastes for industrial uses. Studies are also underway to determine the feasibility of using certain non-potable waters in the home in a separate system. To ensure continuance of these and other programs will require increasing numbers of young and talented engineers, and steps are currently being taken to ensure that such manpower as is needed will be available. (Lowry-Texas)
W72-04430

SLUDGE HANDLING AND DISPOSAL IN TROPICAL DEVELOPING COUNTRIES,
Asian Inst. of Tech., Bangkok (Thailand).
M. B. Pescod.
Journal Water Pollution Control Federation, Vol 43, No 4, p555-570, April 1971. 12 fig, 8 tab, 5 ref.

Descriptors: *Sludge disposal, *Sludge treatment, *Oxidation lagoons, *Anaerobic digestion, Dewatering, Evaporation, Drainage, Temperature, Precipitation, Pilot plants, Laboratory tests, Mixing, Design criteria, *Waste water treatment.
Identifiers: *Solids loading, *Night soil.

Literature reviews and laboratory studies at the Asian Institute of Technology have demonstrated that anaerobic digestion, lagooning, and sandbed drying are the most suitable sludge handling methods now and in the near future for use in tropical developing countries. Anaerobic digestion of nightsoil or primary sludge in the tropics will proceed at temperatures near 30 deg C with no supplemental heating, gas production will be high, and optimal detention times of 10 days will be common. Thorough mixing will allow loading rates to be as high as 4.5 g VS/day/liter of active digester volume. Septic tank sludge will not normally require digestion after collection in tropical environments. For concentration, air drying on sand beds was shown to produce, at bed loading rates between 67.5 and 475 kg dry solids/year/sq. meter, a dried cake containing 35% solids. Sludge application depths of 20 cm were recommended as likely to give maximum bed loading. Most water will be removed by drainage, assisted by slight evaporative losses. Drying lagoons were less efficient in dry season solids handling, and failed altogether during the wet season. Rational design criteria are needed for these areas, but since little has been done, such information is not available. Much work must be done to build up a background of information to aid in the development of the developing countires. (Lowry-Texas)
W72-04432

THE CASE FOR ADVANCED WASTE TREATMENT, CIRCA 1971,
Engineering-Science, Inc., Washington, D.C.
Harvey F. Ludwig.
Water and Sewage Works, Vol 118, No 12, p 406-407, December 1971. 1 ref.

Descriptors: *Research and development, *Planning, *Financing, Costs, Flexibility, On-site investigations, *Tertiary treatment, *Waste water treatment, Water quality control.

Increasing public demands for action in the pollution control field, particularly in tertiary treatment, have caused all available funds to be pressed into service to build traditional type treatment plants. Obviously, traditional installations are not the answer for protecting, let alone enhancing the receiving water quality. The big boom in treatment plant construction has caused servere shortages in research and development funds, so much needed new developments have not been forthcoming. Estimates are that these new developments in order to become reality, will require a research effort ten times that of the present level. While new construction should scarcely be halted, parallel programs in research and planning are essential for long-term gain. Perhaps for every $10 spent in construction, $1 should be spent for research and $1 spent for planning in an attempt to eventually solve the problem without unreasonable expenditure. (Lowry-Texas)
W72-04434

LOW-COST WAYS OF STABILIZING LIQUID AND SOLID ORGANIC WASTES,
Snell (John R.) Engineers, Inc., Lansing, Mich.
J. R. Snell.
Water and Wastes Engineering, Vol 7, No 5, p 54-57, May 1970. 2 fig.

Descriptors: *Waste water treatment, *Activated sludge, *Aeration, Costs, Incineration, *Anaerobic digestion, Pressure, Biochemical oxygen demand, Design criteria, Roofing material, Illinois, Waste disposal, *Oxidation lagoons, *Organic wastes, Liquid wastes, Solid wastes.
Identifiers: *Aerobic digestion, *Clarifier, Compost, Vinyl, *Contact aeration, Agitation, Suspended solids, Thickening, *Chicago.

The wastewater treatment lagoon has been generally accepted as a low-cost approach to waste treatment, but odors caused by this process sometimes cause problems. The contact aeration process may be designed at one half to two thirds the cost of the standard activated sludge process and accomplish the same degree of treatment. The Chicago Sanitary District expects to save about two thirds of the cost of incinerating their solid waste by: (1) thickening the sludge, (2) digesting it anaerobically; (3) pumping it through a pipeline, first 50, then 150 miles, with final disposal by land reclamation. Further modifications of the composting method have also been developed to give much greater savings. Work has been done on a low-cost approach to the anaerobic digestion process for either the settled solids or the total waste. Four lagoons, averaging more than two acres each were designed and built, and each lagoon was covered with a 30 mil. thickness of vinyl or rubber to keep oxygen out and odors and gases in. In addition, several workable low-cost alternatives to the conventional clarifier have been found. The most promising is a 'tube' clarifier made of smooth corrugated sheets of fiberglass roofing, held on about 3-to-4 inch centers at 60 degrees to the horizontal. These and other waste treatment problems will continue to be subject to cost and technology breakthroughs as research and experience progresses. (Biggs-Texas)
W72-04435

DISPOSAL OF SLUDGE FROM ACID MINE WATER NEUTRALIZATION,
West Virginia Univ., Morgantown. Dept. of Civil Engineering.
Show-Jong Yeh, and Charles R. Jenkins.
Journal Water Pollution Control Federation, Vol 43, No 4, p 679-688, April 1971. 12 fig, 4 tab, 5 ref.

Descriptors: *Acid mine water, *Neutralization, *Land reclamation, *Mine wastes, *Sludge disposal, Domestic wastes, *Dewatering, *Filtration, Vacuum drying, Laboratory tests, Hydrogen ion concentration, Nutrients, Growth rates, Design criteria, *Waste water treatment, Pennsylvania.
Identifiers: *Mine spoil, Thickening, Mount Morris (Pa.).

The parameters used in the design of a thickener, a vacuum filter, and a sand drying bed for dewatering and disposal of acid mine water neutralization sludge were determined using bench-scale laboratory setups. Thickening followed by sand drying was demonstrated to offer a reasonable process in dewatering the neutralization sludge, but vacuum filtration was unsuccessful since the high compressibility of the sludge caused a reduction of filter loading rates. The addition of neutralization sludge and/or domestic wastewater sludge to mine spoil raised the pH to the 7.0 to 8.0 range, but the mixture of neutralization sludge and mine spoil showed signs of nutrient deficiency and stunted growth. With 45% mine spoil, equal amounts of neutralization sludge and domestic wastewater sludge produced a higher yield of plants, indicating the potential use of such a mixture in strip mine land reclamation. (Lowry-Texas)
W72-04436

CHROMATE REMOVAL AT A SAUDI ARABIAN FERTILIZER COMPLEX,
Chemical Construction Corp., New York.
J. A. Landy.
Journal Water Pollution Control Federation, Vol 43, No 11, p 2242-2253, November 1971. 6 fig.

Descriptors: *Industrial wastes, *Cooling towers, *Chromium, *Fertilizers, Corrosion, Inhibition, Acid, Hydrogen ion concentration, Chemical reduction, Lime, Chemical Precipitation, Lagoons, Sludge disposal, Fertilizer, Water quality control, *Waste water treatment.
Identifiers: *Chromates, Saudi Arabi.

Scarcity of water on Saudi Arabia's eastern coast forced the Saudi Arabia Fertilizer Company to construct cooling towers to recycle their cooling water. Sulfuric acid was selected to adjust pH levels, and a 40 mg/l chromate level was established for corrosion protection and inhibition of biological growth. A chromate removal system was designed for normal inflow of 3600 gpm of chromate solution, with an ultimate treatment capacity of 4500 gpm. Treatment consists of pH reduction to 2.0 with sulfuric acid, addition of a reducing agent such as sodium metabisulfite, precipitation of the chromium with lime, drying of the precipitate in sludge ponds, and dilution of treatment plant effluent with remaining plant liquid wastes which are non-toxic. A complete description of the equipment and facilities is presented, but no cost analysis was made. Plant influent normally contains 70 mg/l chromate, while the effluent contains 0.5 mg/l of chromium. Final disposal of the treated effluent is via a set of lift pumps located in the lift station in which this stream is blended with uncontaminated plant waste and pumped to the Gulf. (Lowry-Texas)
W72-04437

BASIC EXPERIMENT ON THE REMOVAL OF RADIOACTIVITY FROM WATER,
Niigata Univ., Nagaoka (Japan).
For primary bibliographic entry see Field 05F.
W72-04456

BIOLOGICAL TREATMENT OF LIQUID WASTES AND DISCHARGE TO SANITARY SEWERS,
Allied Chemical Corp., Idaho Falls, Idaho.
Cyrl M. Slansky.
Available from the National Technical Information Service as CONF.-711113-1, $3.00 in paper copy, $0.95 in microfiche. From: Regional training course in Radioactive Waste Management Conference, Tokyo, Japan, November 4, 1971. 10 p.

Descriptors: *Waste treatment, *Waste disposal, *Sewage disposal, *Water pollution, *Water pollution sources, *Biological treatment, Radioisotopes, Effluents, Rivers, Radioactive waste, Sewage effluents, Plutonium, Phosphorus, Iodine.
Identifiers: Radioactivity release, Accident, Civil Defense.

The biological treatment of domestic and industrial waste waters has been in operation for many decades. An initial attempt to remove plutonium by means of activated sludge was made in 1949. Since then, other studies of this nature have been made, but the biological treatment has been less effective than physical or chemical treatments in removing radionuclides. In spite of the relatively unsuccessful use of biological processes, the study of the behavior of radionuclides in biological treatment processes has value in providing information on the limits of radioactive materials released from sewers to rivers, in the planning of procedures to protect the public in event of catastrophic releases of radioactive materials, in following the behavior of sewage plant processes, and in studying the hydraulics of rivers. The biological treatment of waste containing radionuclides is reviewed, and then the disposal of untreated low-level waste to sanitary sewers is discussed briefly. (Houser-ORNL)
W72-04469

INTEGRATED ACTIVATED SLUDGE BIOLOGICAL FILTER PROCESS.
San Buenaventura, Calif.

Available from the National Technical Information Service as PB-206 794, $3.00 in paper copy, $0.95 in microfiche. Environmental Protection Agency, Water Quality Office Report No 17050 EEO, March 1971, 45 p. 20 fig, 4 tab, 2 ref. EPA Program 17050 EEO 03/71.

Descriptors: *Waste water treatment, *Activated sludge, *Trickling filters, *Pilot plants, Domestic wastes, Biological treatment, Biochemical oxygen demand, Research facilities.

A 75,000-gallon per day pilot plant was constructed at the City of San Buenaventura's Eastside Water Reclamation Facility, to evaluate the feasibility of treating domestic wastewaters by combining the two established processes of trickling filtration and complete mixed activated sludge. These processes were combined and evaluated according to the following flow schemes: (1) primary sedimentation, activated sludge, intermediate sedimentation, trickling filter, and final sedimentation; (2) primary sedimentation, activated sludge, trickling filter, and final sedimentation; and (3) primary sedimentation, trickling filter, activated sludge, and final sedimentation. Mechanical problems with equipment and the lack of process control during operation of Flow Scheme No. 1 were responsible for the unstable conditions and unreliable data. The performance of Flow Scheme No. 2 was seriously affected by the lack of concentrated return activated sludge due to floc dispersal, and loss of solids to the final effluent as a result of the mixed liquor passing over the trickling filter. Flow Scheme No. 3 was stabilized and meaningful data was in the process of being collected when a major flood on the Santa Clara River inundated the entire water reclamation facility and pilot plant. Preliminary data indicated that this flow scheme is the most promising combination of the trickling filtration and activated sludge processes. (EPA abstract)
W72-04558

TECHNOLOGY AND MANAGEMENT OF THE ENVIRONMENT,
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 05G.
W72-04562

CATTLE FEEDLOTS AND ALTERNATIVES FOR WASTE MANAGEMENT,
Environmental Protection Agency, Portland, Oreg. Water Quality Office.
For primary bibliographic entry see Field 05G.
W72-04569

HYDROGEN SULFIDE AND METHYL MERCAPTANS REMOVALS WITH SOIL COLUMNS,
Washington Univ., Seattle. Dept. of Civil Engineering.
D. A. Carlson, and R. C. Gumerman.
Proceedings of the 21st Prudue Industrial Waste Conference, Extension Series 121, 1966. p 172-191, 14 fig, 3 tab, 8 ref.

Descriptors: *Degradation, *Hydrogen sulfide, Soil bacteria, Soil types, Odor, Sulfur bacteria, Pseudomonas, Anaerobic conditions, Loam, Sands, Clays, *Waste treatment.
Identifiers: *Methyl mercaptan, *Soil filters, Elution water, Sulfuric acid.

Recently, the soil siltration principle has been introduced and successfully applied to odors emanating from sewage. On this basis, a soil filtration system was chosen to experimentally remove hydrogen sulfide and methyl mercaptan from air. Soil columns 3-1/2 feet long were used over a period of six to eight weeks. On concentrations of 15 mg/l hydrogen sulfide and 775 mg/l methyl mercaptan, efficiencies approached 100%. Different types of soil were used with artificially enriched fertile loam soil being superior in degradative ability to clay, sand, and sandy loam soils. No optimum soil depth could be established, since bacterial population was still increasing at the end of the test period. It appears that a depth of 3.5 feet is near the maximum necessary. The effect of gas settling of the mercaptan gas upon entering the soil columns was negligible. A back pressure of 1.5 inches of water existed in a moist fertile loam soil at a flow rate of 0.35 cfm. (Dorland-Iowa State)
W72-04571

MANURE MITES AND THEIR ROLE IN FLY CONTROL,
Kentucky Univ., Lexington. Dept. of Entomology.
J. G. Rodriguez, Pritam, Singh, and Bob Taylor.
Journal of Medical Entomology, Vol 7, No 3, p 335-341, 1970. 2 fig, 4 tab, 30 ref. Public Health Service No CC 00207.

Descriptors: *Farm wastes, *Insect control, *Mites, Cattle, Poultry, Larvae, Oviposition, Insecticides, Diazinon, Insect eggs, *Waste treatment, Toxicity.
Identifiers: *Flies.

Glypholaspis confusa (Foa) and Macrocheles muscaedomesticae (Scopoli) generally attain their highest populations in stock piles of cattle manure in the fall and early spring. Their food during the fly-free season consists mainly of nematodes. In poultry houses populations of M. muscaedomesticae start building up in manure in the summer. Fuscuropoda vegetans (DeGeer) attains high populations in early summer and continues to build up as the season progresses until late fall. Acarine control of the house fly in a poultry house under semi-field conditions ranged from 86 to 99%, depending in the mites involved. Fourteen chemicals were tested in the laboratory for toxicity to newly-hatched maggots of the house fly and the adult, M. muscaedomesticae. Diazinon, ronnel, Bayer 38156, malathion and dimethoate were relatively toxic to the house fly maggot and relatively non-toxic to the mite. Sugar-based baits were used against the adult flies in the integrated control program with promising results. (Parker-Iowa State)
W72-04572

SOLID WASTE DISPOSAL,
Zurn Industries, Inc., Erie, Pa.
F. R. Bowermen.
Chemical Engineering, Deskbook Issue, Vol 77, No 9, April 27, 1970, p 147-151. 3 fig, 2 tab, 3 ref.

Descriptors: *Solid wastes, *Industrial wastes, *Waste disposal, Municipal wastes, Management, Landfills, Incineration, Sludge disposal, Environmental sanitation.
Identifiers: Collection, Salvage, Recycle, Reuse.

Our annual accumulation of solid wastes amounts to more than one ton per person, or over 200 tons/year. Primarily these wastes are disposed in open dumps, some of which still practice burning. For the near future, the major improvement in our environment will come from converting these facilities to sanitary landfills. The collection of solid wastes is expensive, inefficient and poorly understood. Inevitably, capital intensive mechanical collection systems must replace labor intensive systems. This trend can be seen in Europe and the importation of these systems to the U. S. is beginning. About fifteen percent of our solid wastes are incinerated, a process which has suffered from a poor image due to early designs accomplished before air pollution was a major consideration. New incinerator concepts are emerging which appear to be regenerating interest in this disposal method. Incineration as a sludge conditioning or disposal method has been used and with improvements will continue to be employed. Compaction of solid wastes into bales may increase the utility of using these wastes in areas once denied to the disposal authorities. This decade will see an unprecedented emphasis on salvage, recycle and reuse of solid wastes, with strong support from local and federal government. We are in an era of environmental concern that will spark major changes in our waste management practices. (Goessling-Texas)
W72-04590

SOLID WASTE MANAGEMENT,
Weston (Roy F), Inc., West Chester, Pa.
R. W. Eldridge.
Chemical Engineering, Deskbook Issue, Vol 77, No 9, April 27, 1970, p 143-145. 2 fig, 3 ref.

Descriptors: *Solid wastes, Management, Soil contamination, Air pollution, Water pollution, Sludge disposal, Public health, Environmental effects, Waste disposal.
Identifiers: Recycling, Salvage, Reclamation, Reuse.

All communities have pollution problems. Often there are divergent views as questions of methods and schedules gravely strain industrial-community relationships. The time has come when neither the community nor its industries can ignore the other's problems. Recent anti-pollution activities have made it quite plain that we can no longer address ourselves to one type of pollution or one pollution source at a time. We must consider the total environment in all our activities. If government agencies and industrial firms do not motivate themselves, the public will press for incentives such as special taxes or negative tax benefits to supply the necessary motivation. The public also expects a methodical approach to the elimination of environmental hazards with a realistic time schedule for intermediate objectives. Solid waste management is in an enviable situation since many of the constituents can be reclaimed and reused. Industry has already demonstrated that utilized waste is no longer waste but another resource. Good solid waste management converts waste to resources, and may substitute profit for pollution control expense. Total recycling is, of course, an optimistic goal that is more reasonable for industry than communities. New processes and equipment are needed before we can realize valid solid waste management goals. (Goessling-Texas)
W72-04591

ACTIVATED CARBON BIDS FOR WASTEWATER TREATMENT JOBS,
J. E. Browning.
Chemical Engineering, Vol 77, No 19, September 7, 1970, p 32-35.

Descriptors: *Activated carbon, *Adsorption, *Brines, Municipal wastes, Industrial wastes, Coagulation, Separation techniques, Activated sludge, Sludge, Tertiary treatment, Cost analysis, *Waste water treatment.

Research and Development efforts are proceeding quickly in the application of activated carbon to many industrial and municipal waste treatment problems. The current surge of interest in activated carbon has been largely a result of increasingly stringent discharge requirements with even tighter controls threatened in the near future. Activated carbon systems are currently being used to treat both organic contaminated brines and waste brines from the food processing industry on a pilot scale. Reconditioning of the brines has prompted much interest in recover, reuse, and regeneration schemes. In addition to being used in conjunction with biological treatment, an activated carbon system was developed which bypasses biological treatment altogether by adding a polymer to the water for suspended solids removal prior to carbon treatment. Other examples of current work, including cost estimates, are presented. (Lowry-Texas)
W72-04592

BOISE EYES ONE FUTURE FOR BARK-MARKETS IT AS SOIL CONDITIONER, MULCH,
Boise Cascade Corp., Emmett, Idaho.
Michael D. Sullivan.
Pulp and Paper, Vol 44, No 2, February 1970, p 128-129. 5 fig.

Descriptors: *Pulp wastes, *Wood wastes, *Bark, *Solid wastes, Incineration, Air pollution, Grading, Nitrogen, Ammonia, Mulching, Soil treatment, Idaho.
Identifiers: *Soil aid, *Chunk bark, Grinding, Bagging, *Reuse (Solids), Mulch, Emmett (Idaho).

In order to reduce waste production and the associated burning, a wood plant in Emmett, Idaho recovers 100% of the current bark production for resale as soil conditioner. The 326 to 350 tons of bark produced daily are used as 40% Chunkbark and 60% Soil Aid. Soil Aid is composed of the smallest bark particles which are ground, screened, mixed with anhydrous ammonia, and aged for 90 days. Soil Aid is then a nitrogen producing compost from the day of introduction, as opposed to other composts which utilize nitrogen from the soil to start their own bacterial decomposition. Soil Aid is sold as either rough or fine. Chunk bark is graded as small, medium, large, and mammoth. Both are sold either in bulk or in 3 cu. ft. sealed plastic bags, and both are sold throughout the U. S., including Alaska. (Lowry-Texas)
W72-04593

TREATING TEXTILE WASTES WITH ACTIVATED CARBON,
Fram Corp., East Providence, R.I.
Allen E. Molvar, Clarke A. Rodman, and Edward L. Shunney.
Textile Chemist and Colorist, Vol 2, No 16, August 12, 1970, p 286-290. 11 fig, 2 tab, 6 ref.

Descriptors: *Textiles, *Biodegradation, *Waste water treatment, Color, Hydrogen ion concentration, Temperature, Biochemical oxygen demand, Phosphates, Nitrates, Laboratory tests, Pilot plants, On-site investigations, Sampling, *Activated carbon, Adsorption.
Identifiers: *Dye wastes, *Waste characterization.

250,000 GALLONS/DAY OF WASTEWATER ARE DISCHARGED FROM A PIECE GOODS DYEING AND FINISHING OPERATION WHICH OPERATES 24 HOURS/DAY, 6 DAYS/WEEK. No common solution exists for the treatment of wastes from such an installation, and this case history delineates the steps necessary to establish the treatment scheme (s) to be used. BOD, suspended solids, effluent temperature and pH readings were plotted against time over several week periods to illustrate the variance of the flows. A computerized analysis was used involving a frequency distribution for each pollutant characteristic, providing a relative frequency of occurrence of particular pollutant group concentrations. Based on the profile analysis and laboratory confirmations, a pilot plant process involving an aerobic biological reactor with an activated carbon adsorption system was designed, constructed, and operated. Based on data from this operation, a full-scale plant was conceptualized and designed to provide phosphate reductions of 75%, total nitrogen reductions of 81%, suspended solids reduction of 67%, color reduction of 95%, and BOD reduction of 91%. Individual approaches such as this to waste treatment problems emphasize the need to make optimum use of conventional, non-conventional and so-called advanced treatment techniques in each individual application. (Lowry-Texas)
W72-04595

'THE HOG' CHEWS UP RIEGEL PAPER'S SOLID WASTES PROBLEM.
Riegel Paper Co., Milford, N.J.

Pulp and Paper, Vol 44, No 7, July 1970, p 91-92. 3 fig.

Descriptors: *Incineration, *Pulp wastes, *Solid wastes, Sludge, Filtration, Power plants, Air pollution, Dewatering, Boilers, Water pollution control, *Waste disposal.
Identifiers: *Shredding.

The Riegel Paper Company disposes of ten tons of unusable paper products per day by burning them to produce steam. The heart of the system is a giant hogger, 'The Hog', which shreds the paper at high speeds and produces loose, baled, or roll form products. After shredding, the paper is blown at 60 mph through an 18 in. diameter pipe into the boilers. In addition to the paper some 4 tons/day of clarifier sludge are burned in the boilers after thickening, vacuum belt filtration, and screw pressing concentrate the sludge from 5% to 45% consistency. A cyclone separates the solids from the air stream as the sludge and paper are blown into the furnace. Bulk solids reduction by burning is 90%, and the gaseous/residual solids stream is passed through high volume, low speed bunkers and finally an Aerotec solids separator. No particulates are discharged from the mill stack. (Lowry-Texas)
W72-04596

THE FEDERAL WATER QUALITY PROGRAM AS IT AFFECTS THE TEXTILE INDUSTRY,
Federal Water Pollution Control Administration, Boston, Mass.
For primary bibliographic entry see Field 05G.
W72-04597

PROCESSED GARBAGE-USEFUL MULCH FOR ORNAMENTAL PLANTS,
Auburn Univ., Auburn, Ala. Dept. of Horticulture.
K. C. Sanderson, H. P. Orr, and W. O. Martin, Jr.
Compost Science, Vol 11, No 1, January 1970, p 10. 2 tab.

Descriptors: *Municipal wastes, *Biodegradation, Laboratory tests, *Mulching, Moisture content, Hydrogen ion concentration, Erosion, Temperature, Nutrients, Soil compaction, Weeds, Plant growth, Alabama.
Identifiers: *Compost, *Mobile (Ala).

Research at Auburn University Agricultural Experiment Station has revealed that processed garbage is a suitable material for mulching ornamental plants. Compost produced by the municipal compost plant in Mobile, Alabama was applied to test plots in which ornamental plants were grown. These experiments, under a grant from the U. S. Public Health Service, found processed garbage mulches to be as effective as many other commonly used mulching materials. Several points favoring the use of compost were: (1) it was effective for more than a year; (2) it influences soil moisture, pH, temperature and nutrition; (3) while being resistant to erosion, compost does not pack

or mat; and, (4) weed growth is reduced and plant response greatly improved. (Goessling-Texas)
W72-04598

GREAT BRITAIN MARKS 30 YEARS OF RECLAIMING, RECYCLING,
Drinkwater Services, Inc., London (England).
D. A. Wyatt.
Solid Wastes Management/Refuse Removal Journal, Vol 13, No 8, August 1970, p 18 and 44-46. 2 fig.

Descriptors: *Solid wastes, *Reclamation, *Landfill, Population, Industry, Waste water treatment, Sludge disposal, Incineration, *Water reuse, *Waste disposal.
Identifiers: *Reuse (Solids), *Recycling, Transfer station, Control disposal.

It has been claimed that nowhere more than in the British Isles is higher priority given to finding economical solutions to waste disposal problems. The advent of World War II created the requirement to reclaim and recycle all possible material for reuse. The post WW II era with its rising population, increased affluence, increased wastes, and limited disposal sites all dictated that as much reclamation of waste material be accomplished as possible. This has led to the formation of large disposal/reclamation companies that can economically employ the latest technology. The results of this awareness and improved methods have been quite dramatic; today Britain exports more than $225 million worth of scrap materials annually. Many industries have joined in by tightening up in-plant operations to reduce scrap and recover for reuse waste materials that are produced. Disposal sites are still a real problem as cities expand and more industry locates close to labor markets. The stress in this area is to reclaim otherwise unusable land and this has been quite effective. Plans are now being developed for transfer stations and large over the highway transfer vehicles. The narrow roads in Britain are restrictive but better compaction mechanisms and/or milling should help resolve this problem. With the advent of stricter discharge limits on the nation's waters, transfer stations will handle a good deal of solids and sludges previously discharged to streams. (Goessling-Texas)
W72-04600

HOW REFUSE IS PROCESSED IN FRANCE,
L. C. Herbert.
Compost Science, Vol 11, No 1, January 1971, p 16.

Descriptors: *Solid wastes, Biodegradation, Cost analysis, Unit costs, *Waste disposal.
Identifiers: *Compost, Materials separation, *Reuse (Solids), *France.

The French method of processing refuse is well-worth studying because of the low cost and the effectiveness of the obtained results. Mixed refuse is dumped into a hopper and conveyed to a pulverizer as required. In the pulverizer, moulded plastics, tires, rubber objects and about 90% of the metals are separated and the remaining refuse granulated. The aggregate is taken by tractor-trailer to windows and allowed to mature for six weeks. The half cured compost is sold to farmers and trucked to the location and stored for another six weeks to allow for complete maturation. Typical plant capacity is 40-50 tons per day and is operated by two men. Capital costs are about $120,000. There is a reported loss of nearly $0.10 per ton, which compares favorably with the solid-waste-compost situation in England where collection and landfill costs are about $2.50 per ton. A more complex plant with more sophisticated machinery is located at Annecy. This plant features a radial gantry crane which permits the end product to be stored in large circles about the plant. The simplicity of operation, the cooperation between producer and consumer and the modest cost are good examples of what can be done in solid waste management. (Goessling-Texas)
W72-04601

AGRICULTURAL WASTES: PRINCIPLES AND GUIDELINES FOR PRACTICAL SOLUTIONS.
New York State Coll. of Agriculture, Ithaca.

Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. 172 p.

Descriptors: *Farm waste, *Water quality control, Pesticides, Eutrophication, Liquid waste, Surface runoff, Dehydration, *Waste water treatment, Oxidation lagoons, Incineration.
Identifiers: Composting, Land spreading.

The purpose of this 1971 Conference was to take the knowledge obtained from research and field experience and convert this knowledge into information which can be used to solve the problems in agricultural waste management. Another benefit of this proceedings may be to point out areas where the information is weak or missing. This could be helpful in planning more appropriate research in the future. (See W72-04605 thru W72-04629) (Bundy-Iowa State)
W72-04604

AGRICULTURE:S RESPONSIBILITIES IN A CLEAN ENVIRONMENT,
New York State Dept. of Environmental Conservation, Albany.
For primary bibliographic entry see Field 05G.
W72-04605

ENVIRONMENTAL QUALITY AND PRODUCTIVITY,
Environmental Protection Agency, Washington, D.C. Water Quality Office.
For primary bibliographic entry see Field 05B.
W72-04606

PESTICIDES AND PEST CONTROL IN THE FUTURE,
Cornell Univ., Ithaca, N.Y. Dept. of Entomology.
For primary bibliographic entry see Field 05G.
W72-04607

FARM LAND RUNOFF,
Cornell Univ., Ithaca, N.Y. Dept. of Natural Resources.
For primary bibliographic entry see Field 05B.
W72-04608

ENVIRONMENTAL PROBLEMS IN THE FOOD PROCESSING INDUSTRY,
Cornell Univ., Ithaca, N.Y. Agricultural Experiment Station.
For primary bibliographic entry see Field 05B.
W72-04609

FERTILIZER PRACTICES WHICH MINIMIZE NUTRIENT LOSS,
Cornell Univ., Ithaca, N.Y. Dept. of Agronomy.
For primary bibliographic entry see Field 05B.
W72-04610

LAND DISPOSAL OF MANURE IN RELATION TO WATER QUALITY,
Cornell Univ., Ithaca, N.Y. Dept. of Soil Science.
S. D. Klausner, P. J. Zwerman, and T. W. Scott.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. p 36-46, 8 tab, 10 ref.

Descriptors: *Farm wastes, *Surface runoff, *Fertilization, Soil erosion, Water pollution, Eutrophication, *Waste disposal, Waste water treatment, *Nutrients.

Disposal on land is the most practical final placement for farm manure, as it is a source of plant nutruent and organic matter. Nitrogen in manure is very mobile in a soluble form. Phosphorus becomes 'fixed' and is removed largely by the physical removal of soil, organic matter, or manure by surface erosion. Vegetation acting as a sink for incoming nutrients as well as a control of erosion are necessary for control of nutrient removal. Incorporating the manure with the soil shortly after spreading is an important consideration as immobilization of nutrients increases and odor and fly problems decrease. Winter spreading causes numerous problems. Frozen soil is impervious to water and subject to runoff during thaws. Spring applications of manure can pose a threat to water quality if improperly managed. Late in the spring, surface and subsurface flows of water are no longer at maximum levels, thus decreasing the pollution potential. Concrete evidence as to the maximum rates of manure that can be applied without causing a polltuion hazard under most soil and weather conditions is non-existent. Continuing research hopefully can answer unsolved problems of economic means of handling animal wastes. (See also W72-04604) (Schmitt-Iowa State)
W72-04611

ANIMAL WASTE HANDLING IN THE UNITED KINGDOM,
Cornell Univ., Ithaca, N.Y. Dept. of Poultry Science.
C. E. Ostrander.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. p 52-53.

Descriptors: *Farm wastes, *Dehydration, *Waste water treatment, Aerobic treatment, Anaerobic digestion, Domestic wastes.

The poultry industry in England, Scotland, and Holland is quite different from that in the United States. There are many smaller operations in the 1,000 to 5,000 bird range, they have less mechanization, and they look at quality differently. However, one of the world's largest poultry operations is located near Nottingham, England and produces 60,000,000 broilers a year in addition to maintaining 3,500,000 laying hens. There is much interest in the United Kingdom in dehydration of manure. This is probably due to the fact that they can include dehydrated poultry manure in commercial feed formulations. The United Kingdom is very concerned about water pollution as they depend on rivers for water supply and do not want polluted effluent dumped into them. Holland appeared to be putting fairly potent effluent into drainage ditches. They have tried natural lagoons, but low temperatures and lack of sunshine prevented proper operation. Some are converting to aerated lagoons. Other methods being tried include the Floc-tower system, centrifuging, anaerobic digesting, and aeration in oxidation ditches. They are concentrating livestock, and waste problems are becoming more acute. (See also W72-04604) (Schmitt-Iowa State)
W72-04612

GUIDELINES FOR MINIMIZING PESTICIDE POLLUTION,
Cornell Univ., Ithaca, N.Y. Chemical-Pesticide Program.
For primary bibliographic entry see Field 05G.
W72-04613

LIQUID WASTE TREATMENT I. FUNDAMENTALS,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
R. C. Loehr.
In: Agricultural Wastes: Principles and Guidelines for Practical Solution, Cornell University Conference on Agricultural Waste Management,

February 10-12, 1971, Syracuse, New York. p 54-62, 1 fig, 1 tab.

Descriptors: *Farm wastes, *Aerobic treatment, *Anaerobic digestion, Pollution abatement, *Waste water treatment.

Controlled and uncontrolled biological systems are the major systems used to treat organic wastes. The systems can treat liquid or solid wastes, can be aerobic, anaerobic, or facultative, and can be within controlled structures or unconfined on the land. In biological systems microorganisms utilize the biodegradable wastes for food. Synthesis or growth is affected by the ability of the microorganisms to metabolize the wastes, the temperature and pH of the system, and the presence of adequate nutrients, trace elements, and toxic materials. It is not possible to have a system in which there is no net accumulation of solids with time due to nonbiodegradable material. Bacteria are the most important group of microorganisms followed by fungi, whih re non-photosynthetic multicellular plants. Algae are photosynthetic autotrophs, utilizing sunlight and inorganic compounds to synthesize cells. In aerobic treatment carbon is oxidized to microbial protoplasm and carbon dioxide, while in anaerobic systems some carbon is reduced only to methane. For optimum nitrification a dissolved oxygen concentration of about 2 mg/l is necessary. In general, microbial reaction rates are doubled for every 10 deg C rise in temperature of the waste system. (See also W72-04604) (Schmitt-Iowa State)
W72-04614

LIQUID WASTE TREATMENT II. OXIDATION PONDS AND AERATED LAGOONS,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
R. C. Loehr.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. p 63-71, 3 fig, 1 tab, 2 ref.

Descriptors: *Farm wastes, *Oxidation lagoons, *Farm lagoons, *Aeration, *Aerobic treatment, Dissolved oxygen, *Waste water treatment.

Oxidation ponds and aerated lagoons are among the simplest liquid waste treatment systems currently used. Bacteria and algae are the key organisms in an oxidation pond, with the active bacterial mass under 50 mg/l. In most oxidation ponds there are ample algal nutrients in the influent carriage water and resulting from bacterial metabolism to produce excess oxygen from algal growth. Satisfactory performance depends on the balance between the bacteria and the algae. Oxidation ponds are organic matter generators, since algal cells are produced. Unless algal cells are removed from the effluent of the pond prior to discharge, little reduction in the ultimate waste load will have occurred. Temperature affects the rate of metabolism of microorganisms; thus, the rate at which the pond can be loaded. Loading relationships should be in terms of BOD5 per surface area per day, and generally range from 20 to 50 pounds per acre per day. An aerated lagoon differs from an oxidation pond in that aerobic conditions are maintained by mechanical means, with algae generally not present. Dissolved oxygen should be maintained at 1-2 mg/l with the detention time from 1-10 days. (See also W72-04604) (Schmitt-Iowa State)
W72-04615

LIQUID WASTE TREATMENT III. THE OXIDATION DITCH,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
R. C. Loehr.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. p 72, 2 fig, 1 tab, 1 ref.

Descriptors: *Farm wastes, *Sewage treatment, *Aerobic treatment, Oxygen demand, Stabilization, Oxidation lagoons, *Waste water treatment.

The oxidation ditch, or Pasveer ditch, is an aerobic biological waste treatment system with a long liquid detention time and adequate mixing. The key components are a continuous open channel and a surface aeration rotor, which mixes the ditch contents and supplies oxygen. Untreated wastes can be added directly to the ditch. The effluent from agricultural wastes normally is not suitable for discharge to surface waters, but is suitable for land disposal. If sufficient oxygen is supplied, odors are negligible. BOD5 reductions of 80-90% can be obtained. Characteristics include low capital cost, ease of operation, and minimum maintenance. The total solids concentration can range up to 4-6%. Because of long detention times, the food to organism ratio is only from .03 to 0.1 lb. BOD per lb. MLVSS (Mixed Liquor Volatile Suspended Solids) per day. Velocities of 1.0 to 1.5 ft./sec. should be maintained to minimize settling. The depth of liquid ranges from 15 to 30 inches with rotor immersion one-fourth to one-third the liquid depth. Livestock oxidation ditch effluent must be kept in aerated holding units or disposed of in a short time to avoid anaerobic conditions and odors. (See also W72-04604) (Schmitt-Iowa State)
W72-04616

ANAEROBIC BIOLOGICAL WASTE TREATMENT SYSTEMS,
Cornell Univ., Ithaca, N.Y. Dept. of Environmental Engineering.
A. W. Lawrence.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agriculture Waste Management, February 10-12, 1971, Syracuse, New York. p 79-92, 6 fig, 3 tab, 18 ref.

Descriptors: *Farm wastes, *Anaerobic digestion, *Methane bacteria, *Waste water treatment, *Farm lagoons, Pollution abatement.

The anaerobic process, one of the major biological wastewater treatment processes, is most effectively applied in the treatment of concentrated wastes, such as those from animal production exceeding 1% organic solids. The anaerobic process converts organic matter to methane and carbon dioxide. The methane can be vented to the atmosphere or burned as a heat source. Microbiologically, the anaerobic process is complex with many species of microorganisms involved. However, the bacteria can be functionally divided into two groups, acid formers and methane formers. The methane producing bacteria are extremely sensitive to environmental change. A typical organic loading rate for a completely mixed tank is .2 lb. volatile solids per day per cubic foot. Completely mixed systems are quite expensive and require extensive operator control, which makes them unattractive for agricultural purposes. The lagoon is probably the most widely used anaerobic process configuration in agricultural waste treatment at this time. Attractions include low capital and operating costs and minimal operating requirements. Anaerobic processes can be designed by either the rational approach which applies to completely mixed systems or the empirical method which is used in designing lagoons. (See also W72-04604) (Schmitt-Iowa State)
W72-04617

CHLORINATION OF WASTEWATER EFFLUENTS,
Cornell Univ., Ithaca, N.Y. Dept. of Environmental Engineering.

In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. p 93-101.

Descriptors: *Farm wastes, *Disinfection, *Chlorination, Water treatment, Public health, Waste water treatment, Diseases.

Certain diseases caused by enteric pathogenic microorganisms can be transmitted from infected human and animal sources to susceptible human populations by water supply systems. Examples include typhoid and cholera. Due to water supply and recreational use of our rivers, there is a trend to require disinfection, or chlorination, of sewage and wastewater. Aqueous solutions of chlorine can be prepared from either dissolution of gaseous chlorine or the hypochlorite salts. Chlorine, as a strong chemical oxidizing agent, inactivates the key enzyme systems within the pathogenic microorganism. The process of chlorination is usually controlled by measurement of the chlorine residuals and is called the orthotolidine test. Pathogenic organisms are usually present in very low numbers; therefore, indicator organism used in wastewater is called the coliform group, consisting of bacteria of intestinal origin of warm-blooded animals, the same origin as the pathogens. Coliforms, however, have a longer survival time in natural waters. Factors affecting disinfection include temperature, contact time, concentration, chlorine species present, pH, and type of organism. Cost of chlorination is on the order of one cent per thousand gallons of wastewater, with control of the process being straightforward and relatively simple. (See also W72-04604) (Schmitt-Iowa State)
W72-04618

SOLIDS DESTRUCTION OR SEVERE TREATMENT,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
D. C. Ludington.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. p 102-106, 1 fig, 1 tab, 3 ref.

Descriptors: *Farm wastes, *Waste water treatment, *Incineration, *Solid wastes, Pollution abatement, Chemical degradation.
Identifiers: Wet-air oxidation process.

There are three basic processes which can be used to destroy solid matter or convert solid matter into liquids or gases. These three processes are (1) biological, (2) chemical, and (3) thermal. A biological process is one which utilizes bacteria to decompose or break down solid matter. These processes can only attack those solids which can be biologically degraded. Biological processes can be subdivided into two categories; aerobic which require the presence of dissolved oxygen, and anaerobic which takes place in the absnece of dissolved oxygen and produces offensive odors as products of destruction. Total reduction for biological destruction is 30-50%. Chemical destruction of solids is a process which chemically oxidizes the solid material in an aqueous solution at high pressure and temperature and in the presence of air but without a flame. The process, also known as the wet air oxidation process, operates at temperatures about 500 deg F and pressures from 150 to 3000 psig and can effectively convert all the volatile solids in solid material into carbon dioxide, water, and nitrogen. Thermal destruction is the rapid oxidation at temperatures 1000 to 1400 deg F, near atmospheric pressure and with a flame. Also known as incineration, this process can convert all the volatile solids to gaseous products and heat. (See also W72-04604) (Schmitt-Iowa State)
W72-04619

MOISTURE REMOVAL,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
A. T. Sobel.

In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. p 107-114, 7 fig, 1 tab, 4 ref.

Descriptors: *Farm wastes, *Dehydration, *Drying, *Absorption, Waste storage, Incineration, Waste water treatment.

Removal of water from animal manures provides many advantages for manure management systems, including a reduction in offensive odor, a reduction in weight and volume, and a change in handling characteristics. The range of ideal moisture content is 10-15%, since ammonia is produced in the 75-15% range, and below 10%, the manure becomes dusty. The possible means of water removal are, (1) mechanical, (2) absorption, and (3) thermal. Mechanical removal consists of using pressure to force the water from manure. Absorption is a functional method of moisture removal as long a sufficient absorption material and air movement is provided. Thermal means of moisture removal can be subdivided into dehydration and drying. Dehydration, the removal of moisture at a temperature considerably greater than ambient, must be accomplished in complex equipment with the added cost of a fuel source. Drying, the removal of water by evaporation at a temperature slightly above ambient, is controlled by, (1) environment, (2) configuration, and (3) air movement. Thickness of manure should be 1/4 inch or less for drying with a maximum air flow of 800 fpm. Dehydration should be considered only if there is a market available for the dehydrated product, or if the cost is considered a treatment. (See also W72-04604) (Schmitt-Iowa State)
W72-04620

COMPOSTING,
Rutgers - The State Univ., New Brunswick. N.J. Dept. of Soils and Research.
S. J. Toth, and B. Gold.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. p 115-120, 2 tab, 11 ref.

Descriptors: *Farm wastes, *Artificial use, *Aerobic conditions, *Humus, Thermophilic bacteria, Carbon cycle, Decomposing organic matter.
Identifiers: *Composting.

The production and use of artificial manures or coposts for soil improvement practices is as old as the art of agriculture. Composting can be defined as the process involving the conversion of organic residues into liqnoprotein complexes (humus) via thermophilic organisms under optimum moisture and aeration conditions. In the process, CO2 is evolved and the temperature of the pile may reach 155 to 170 deg F. Air moisture, nitrogen, phosphorus, and potassium are necessary ingredients for composting. Unless sufficient moisture is present the pile will dry out and decomposition will cease. If too much moisture is present or air is excluded, anaerobic conditions are produced and obnoxious odors will result. Microorganisms require nitrogen for their growth so composts made from plant materials with less than 2% total nitrogen will require the addition of either organic or inorganic nitrogen. Small amounts of additional phosphorus and potassium may be needed, with 20 pounds of superphosphate and 10 pounds of muriate of potash usually being sufficient. Any materials containing cellulose can be composted, the only exceptions being plastics and resins with a closed ring structure. Characteristics of ideal compost include dark color, inorganic matter content of 80% or more, moisture content between 10 and 20% total nitrogen from 2.5 to 3.5%, and a pH between 5.5 and 6.5. Due mainly to low organic matter, garbage composting in the United States has been largely unsuccessful. (See also W72-04604) (Schmitt-Iowa State)
W72-04621

UTILIZATION OF AGRICULTURAL WASTES,
Agricultural Research Service, University Park, Pa.
W. R. Heald, and R. C. Loehr.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. p 121-129, 49 ref.

Descriptors: *Farm wastes, *Waste disposal, *Water reuse, Fertilization, Artificial use, Waste disposal.
Identifiers: Recycling.

Waste management can be thought of in three categories: the prevention of, the recovery of, or the disposal of wastes. Recovery, or recycling is the return of wastes to its natural state, and along with salvage, or utilization of wastes is potentially the most efficient operation. The land will continue to be the ultimate disposal site for animal wastes, and is considered a recycling process when coupled with crop production. Benefits other than nutrient value include increased infiltration capacity of the soil, and reduced soil erosion resulting from better plant cover. Methods of utilizing animal wastes are composting, energy or methane production and refeeding. Composting is feasible but a market must be developed before the process is financially attractive. In general, the nutritive value derived from animal wastes incorporated in feed rations is greater if the wastes of single stomached animals are added to the feed ration of ruminants and if the ruminant wastes are treated chemically before being added to feed rations. Unknowns related to transmittal of drugs, feed additives, and pesticides to the second animal and to the agricultural product, such as eggs and milk, remain to be classified. A variety of costs must be developed before the value of utilization and recycling can be determined. (See also W72-04604) (Schmitt-Iowa State)
W72-04622

ODORS AND THEIR CONTROL,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
D. C. Ludington.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. p 130-136, 1 fig, 1 tab, 12 ref.

Descriptors: *Farm wastes, *Odor, *Poultry, Runoff, Water pollution, Air pollution, Air circulation, Waste treatment.
Identifiers: *Odor control, Soil columns, Cages, Plow-furrow-cover, Oxidation ditch, Chemical treatment, Odor control costs.

The seriousness of odors produced from poultry operations have increased with changes to the 'modern' poultry house. Sources of odors around a poultry operation includes: (a) ventilation air, (b) loading areas and outside storage tanks, and (c) the land after spreading. Controlling odors from these sources can be accomplished to varying degrees by different methods. The following list of odor control methods is an attempt to put these methods in perspective as to success of odor removal. Ranking of odor control methods for the various odor sources: (a) Ventilation air: (1) adequately aerated liquefied manure, (2) moisture removal (moisture content reduced to 30-40% w.b.), (3) frequent (daily) cleaning, (4) chemical treatment (if sufficient chemical is used, this treatment could be higher on the list); (b) Loading area and outside storage tanks: (1) adequately aerated liquefied manure, (2) moisture removal (30-40%), (3) chemical treatment; (c) Land after spreading: (1) adequately aerated liquefied manure, (2) plow-furrow-cover or sub-surface injection, (3) moisture removal, (4) frequent cleaning and spreading (daily), (5) chemical treatment. The final decision on an odor control method must be based upon cost and the local situation. The local situation depends upon nearness of neighbors or degree of odor control necessary. No matter how carefully the method is chosen, if good management and good housekeeping are not followed, the system will fail. (See also W72-04604) (Bundy-Iowa State)
W72-04623

WASTE HANDLING ALTERNATIVES,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
R. W. Guest.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. p 137-141, 2 fig.

Descriptors: *Farm wastes, Liquid wastes, Odor, Waste storage, Storage capacity, Aerobic treatment, Oxidation lagoons, Cattle, Poultry, Swine, *Waste water treatment, Waste disposal.
Identifiers: *Semi-fluid material, Manure spreaders.

Methods of handling agricultural manures are changing. The reason--primarily because the predominant form of the manure has changed. Prior to ten years ago, more or less, straw or other bedding was used which absorbed part of the moisture in the manure. Not only has the form changed, but also a drastic increase in the volume of waste material to be handled in one location has occurred. The conventional method of handling manure is with the conventional manure spreader (without modification), gutter cleaners, pit scrapers and manure bucket loaders. To be successful using the conventional method, dairy manure and poultry manure must have dry matter added, whereas swine manure can be spread without added dry matter. Semi-fluid material is of most interest because most of today's large operations use this method. The solution to handling semi-fluid rests with three alternatives: (1) develop equipment to handle it in this form, (2) change to liquid by adding water, or (3) change the form to a solid. The liquid handling is gaining popularity because conventional mechanical pumping methods may be used. The ease of storing liquids is also an advantage for using this system. It enables an operator to store manure, thus reducing labor. The treatment process must be considered, however, in any of these systems to reduce odors. (See also W72-04604) (Bundy-Iowa State)
W72-04624

INTEGRATION OF COMPONENTS INTO A SYSTEM,
Cornell Univ., Ithaca, N.Y. Dept. of Poultry Science.
For primary bibliographic entry see Field 06E.
W72-04625

ADVISORY GROUPS FOR ENVIRONMENTAL PROTECTION AND AGRICULTURAL COOPERATION,
Wisconsin Univ., Madison. Dept of Dairy Science.
For primary bibliographic entry see Field 06E.
W72-04626

WASTE MANAGEMENT ON A MODERN DIARY FARM,
R. Everingham.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York, p 157-160.

Descriptors: *Farm waste, *Cattle, Confinement pens, Soil disposal fields, Septic tanks, Odors, Liquid wastes, New York, Waste treatment.
Identifiers: *Dairy wastes, Liquid-manure spreader, Pit agitation, *Syracuse (N.Y.).

A New York dairy farmer gives an account of his 100-cow free-stall liquid-manure-handling system.

The system is located within a 15-minute drive to downtown Syracuse, which makes him very aware of the odor problems that a dairy operation might cause. The liquid manure tank was designed on the specifications of 1-1/2 cubic feet per animal per day with enough capacity for two months. At the time the pit was built, it was decided that a two-month clean-out period would be sufficient, but after operating the system for awhile, it was recognized that a four-month period would be better. This would eliminate having to spread the manure during the summer months or the cold winter months on frozen ground. Also, the specifications of 1-1/2 cubic feet per animal per day should be increased to 2. The equipment used to remove the manure consists of an agitator pump and a 1400-gallon liquid-manure spreader. In his operation, the spreading, especially in the summer, is the most critical part of the operation. The operator at this point feels the system is workable. (See also W72-04604) (Bundy-Iowa State)
W72-04627

PERFORMANCE OF DUCK WASTEWATER TREATMENT FACILITIES,
New York State Veterinary Coll., Eastport. Duck Disease Research Lab.
K. J. Johanson.
In: Agricultural Wastes: Principles and Guidelines for Practical Solution, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York, p 161-166. 3 fig, 3 ref.

Descriptors: *Farm waste, *Poultry, Oxidation lagoons, Settling basins, Waste water disposal, *Waste treatment, Chlorine, Run-off, *Treatment facilities.
Identifiers: *Pre-settling lagoon, Confined buildings, *Duck wastes.

The Long Island duck industry is presently comprised of 35 farms and processing plants, marketing approximately 7 million ducks a year. This figure represents about 65% of the nation's ducks with the majority going to New York restaurants and markets. A minimum of 6 gal. of water per duck per day is necessary. Most farmers use between 10 and 20 gal. of water per duck per day. In the past, ducks were given free access to the freshwater streams and rivers and their wastes were carried out into the waterway, which caused serious pollution. In order to curb this pollution, the New York State Department of Health required duck farmers to comply with a four-phase program of water pollution abatement. The first two phases of this program called for the removal of ducks from open waters and providing facilities that would remove settleable solids. The third phase of the order called for the disinfection of the waste effluent. The fourth phase called for nutrient removal. Each farm involved in waste treatment is issued an operating permit after the system has been inspected and approved by the New York State Dept. of Environmental Conservation. The permit describes the approved facilities and specifies what equipment is incorporated into the system, such as the size, number and capacity of aeration lagoons, settling lagoons, chlorination tanks, pumps, and the number of aerators to be utilized. These facilities cannot be altered without prior approval of the New York State Department of Environmental Conservation. (See also W72-04604) (Bundy-Iowa State)
W72-04628

FOOD PROCESSING WASTEWATER TREATMENT,
Harnish and Lookup, Assoc., Newark, N.Y.
P. Russell.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York, p 167-172. 3 fig, 2 tab, 14 ref.

Descriptors: *Waste water treatment, Irrigation, Lagoons, Activated sludge, Aeration, Water management, New York.
Identifiers: *Food processing, Wastes, Spray irrigation.

In the food processing sector of the agricultural industry, wastewater treatment and disposal is one of the most significant problems facing today's corporate management. In New York state alone, over 100 food processing plants produce wastewater equivalent to 5 million people. The problem must be completely determined in order to provide a proper wastewater management program. An in-plant wastewater sampling program is essential to determine wastewater sources and characteristics. A process flow schematic is also essential. To treat the wastewater, preliminary treatment includes screening, nutrient additions, pH control, and equalization in many cases. In some cases, spray irrigation is a very suitable means for wastewater disposal from food processing operations. The important elements of a spray irrigation system are adequate surface area and a soil which allows for infiltration into the ground. In other instances where a BOD removal efficiency up to 85% is adequate, aerated lagoons have been employed successfully in treating food processing wastewaters. Methods including stabilization ponds, filter, and chemical treatment are used when advanced treatment is necessary. (See also W72-04604) (Bundy-Iowa State)
W72-04629

RENOVATION OF TREATED MUNICIPAL SEWAGE EFFLUENT AND DIGESTED LIQUID SLUDGE THROUGH IRRIGATION OF BITUMINOUS COAL STRIP MINE SPOIL,
Pennsylvania State Univ., University Park. Dept. of Forestry and Wildlife.
F. Hunt.
M.S. Thesis, September 1971, 118 p. 18 fig, 45 tab, 37 ref. OWRR B-020-PA (6).

Descriptors: Spoil bank, *Sewage effluent, Sludge, Land reclamation, *Strip mine wastes, Reforestation, Irrigation, *Waste water treatment, *Sprinkler irrigation, *Nitrogen compounds, *Percolation, *Coal mine wastes, *Water reuse, *Phosphorous compounds, Potassium, Calcium, Sodium.
Identifiers: Nitrate-nitrogen concentration.

Sewage effluent and sludge were applied singly and in combination at rates of 1 and 2 inches per week by sprinkler irrigation on spoil bank material placed in large boxes (32 ft. long, 4 ft. wide, and 4 ft. deep). Percolate samples were collected each week for 24 weeks and analyzed to determine water quality changes. Results indicated that 98 percent of the orthophosphate phosphorus was removed. Nitrate-nitrogen concentrations were greatly reduced but still remained above potable water standards. Concentrations of aluminum, iron, manganese, and boron were all reduced considerably reducing toxicity to vegetation. Concentrations of potassium, calcium and sodium were also significantly reduced. (Sopper-Pa)
W72-04634

POTENTIALS FOR REUSE OF WASTEWATER IN NORTH CENTRAL TEXAS,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials; and Camp, Dresser, McKee, Boston, Mass.
J. E. McKee.
Water Resources Bulletin, Vol 7, No 4, p 740-749, August 1971. 1 tab.

Descriptors: *Water reuse, *Reclaimed water, *Electric power industry, *Cooling towers, *Cooling water, Waste water treatment, Water users, Water quality, Texas.
Identifiers: *North Central Texas.

The reclamation and reutilization of municipal wastewater in North Central Texas represents a potential means for increasing the total resources of the area. The possibility of reutilization is enhanced by new regional water quality requirements necessitating a high degree of treatment of municipal wastewater just for discharge to surface streams. Thus, the wastewater should be suitable for several forms of reutilization with little or no additional treatment. While some demand may arise from other directions, the largest potential user of well-treated municipal effluent appears to be the steam-electric power industry. Within the next decade the generating capacity for power in North Central Texas will more than double, creating a substantial demand for cooling water. Using treated wastewater for this purpose would offer the following advantages to the power industry: the consistent availability of cool water, the location of the cooling water source near power demand centers, and the allowance for future power plant expansion because of ample supplies of cooling water. Municipalities, in turn, would enjoy the advantages of a ready market for treated wastewater and the availability of electric power in large quantities. (Settle-Wisconsin)
W72-04695

DEWATERING FLORIDA PHOSPHATE PEBBLE ROCK SLIME BY FREEZING TECHNIQUES,
Bureau of Mines, Tuscaloosa, Ala. Tuscaloosa Metallurgy Research Center.
Martin H. Stanczyk, I. L. Feld, and E. W. Collins.
Available from the National Technical Information Service as PB-200 702, $3.00 in paper copy, $0.95 in microfiche. Report of Investigation RI7520, June 1971, 20 p, 4 fig, 12 tab.

Descriptors: *Dewatering, *Freezing, *Phosphate, *Slime, *Florida, Ice, Flash freezing, Crystal growth, Thermal capacity, Latent heat, Flocculation, Filtration, Separation techniques, Slurries, Colloids, Mine wastes, Waste treatment, Waste disposal, Waste dumps.

Freezing to dewater typical Florida phosphate rock washer slime was demonstrated in laboratory tests. The washer slime, a waste slurry of fine mineral from concentrating Florida phosphate, has colloidal properties that prevent settling of the solids and make disposal or utilization difficult. The freezing process appeared to have potential commercial use because of indicated moderate energy requirements, compaction of dewatered solids, and recovery of usable water. Batch freezing of gallon-size 13.7% solid slime samples yielded 42% solid products after freezing, thawing, decanting, and filtering. Cationic amine used as a process additive yielded a 46.8% solids product with significantly less filter area. Semicontinuous freezing tests using eight stages also produced thickened slimes. Best dewatering was obtained when ice crystals were allowed to grow and disrupt the colloidal micelle units. Cooling and freezing 13.7% solid slime from 30 deg to -10 deg C required removing 183 Btu per pound of slime; Carnot cycle calculation indicated theoretical minimum energy to transfer this heat was 27.8 Btu per pound. To produce one ton of 44% solids slime from 13.7% solids slime, the calculated theoretical energy required for cooling and freezing was 52.3 kwhr. Slime heat capacity and heat of fusion data were developed during the research.
W72-04698

RECOVERY OF PHOSPHATES AND METALS FROM WASTE PHOSPHATE SLUDGE BY REDUCTION-SINTER PROCESSES,
Bureau of Mines, Rolla, Mo. Rolla Metallurgy Research Center.
R. F. Waters, H. E. Powell, and A. A. Cochran.
Available from the National Technical Information Service as PB-201 891, $3.00 in paper copy, $0.95 in microfiche. Report of Investigation RI 7533, July 1971. 10 p, 3 fig, 5 tab, 8 ref.

Descriptors: Industrial wastes, *Waste treatment, Pollution abatement, *Phosphates, *Metals,

Chemical wastes, Water pollution sources, Water pollution control, Conservation, Iron, *Sludge treatment.
Identifiers: Lead, Zinc, Nickel, *Automotive waste recovery.

The Bureau of Mines developed laboratory-scale processes to recover sodium phosphates and metal values from waste sludges generated by the phosphate treatment of automobile and appliance components. After treatment of the sludge with a stoichiometric amount of NaOH, followed by coke or hydrogen reduction and sintering, zinc and lead were recovered as fume; the sinter was separated by water-leaching into a metallic product, chiefly iron and nickel, and high-purity disodium or trisodium phosphate. Hydrogen reduction-sinter tests at 800 deg C on phosphate sludge from the treatment of automobile bodies, and at 950 deg C on sludge from the treatment of steel used in appliances, produced metallic residues of iron or iron and nickel with very low contents of both phosphorus and zinc.
W72-04699

5E. Ultimate Disposal of Wastes

DEVELOP SAFETY CODE FOR CHEMICALS AT DISPOSAL SITES,
New Jersey State Dept. of Health, Trenton.
For primary bibliographic entry see Field 05D.
W72-04221

CONVERSION OF DESALINATION PLANT BRINES TO SOLIDS,
Badger (W. L.) Associates, Inc., Ann Arbor, Mich.
For primary bibliographic entry see Field 03A.
W72-04323

SOLID WASTES SCHEMES SIFTED,
For primary bibliographic entry see Field 05D.
W72-04422

ACTIVITY RELEASE AND CONTROL AT THE NUCLEAR POWER STATIONS KWL LINGEN, KRB GUNDREMMINGEN, VAK KAHL AND KWO OBRIGHEIM,
For primary bibliographic entry see Field 05B.
W72-04457

SCIENTIFIC BASING AND PRACTICE OF LIQUID RADIOACTIVE WASTES DISPOSAL IN DEEP GEOLOGICAL STRATA,
Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow.
V. I. Spitsyn, M. K. Pimenov, F. P. Yudin, and V. O. Balukova.
Available from the National Technical Information Service as A/CONF.49/P/426, $3.00 in paper copy, $0.95 in microfiche. Report A/CONF.49/P/426, June 1971, Fourth United Nations International Conference on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6-16 September 1971. 32 p, 2 fig, 5 tab, 6 ref.

Descriptors: *Nuclear wastes, *Waste disposal, Radioactive waste disposal, *Geologic formations, Stratigraphy, Hydrogeology, Aquifers, Aquifer characteristics, Groundwater, Groundwater basin, Hydrology, Porous media.
Identifiers: Medium level wastes, Deep well, Subterranean.

The disposal and treatment of liquid wastes from the nuclear industry and nuclear power stations is the subject of large scale studies in the USSR. The burial of radioactive wastes into deep geological strata is one of promising approaches. The general geol gical and hydrogeological preconditions and the practice of subterranean disposal of waste solutions and other medium-activity liquid residues into porous weakly mineralized aquifers are discussed. Such aspects of the method as characteristics of the liquid waste, interaction of liquid wastes with stratum material and observation of waste migration are described. (Houser-ORNL)
W72-04467

THE MANAGEMENT OF RADIOACTIVE WASTES AND THEIR LONG-TERM STORAGE,
Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 05C.
W72-04468

BIOLOGICAL TREATMENT OF LIQUID WASTES AND DISCHARGE TO SANITARY SEWERS,
Allied Chemical Corp., Idaho Falls, Idaho.
For primary bibliographic entry see Field 05D.
W72-04469

WATER POLLUTION POTENTIAL OF SPENT OIL SHALE RESIDUES.
Colorado State Univ., Fort Collins.

Environmental Protection Agency, Water Quality Office, Water Pollution Control Research Series, December 1971, 116 p. 32 fig, 18 tab, 29 ref. EPA-WQO Grant No. 14030 EDB 12/71.

Descriptors: *Salinity, *Oil shale, *Colorado River, *Colorado, *Sodium sulfate, *Rainfall simulators, Capillary action, Snowfall, Erosion control, Soil temperature, Water analysis, Soil chemistry, Soil water movement, Overland flow, Rainfall intensity, Porous media, Water pollution sources.
Identifiers: Specific conductance, Soil evaporation, TOSCO II process, Piceance Basin (Colo), Parachute Creek.

Physical properties, including porosity, permeability, particle size distribution, and density of spent shale from three different retorting operations, (TOSCO, USBM, and UOC) have been determined. Slurry experiments were conducted on each of the spent shales and the slurry analyzed for leachable dissolved solids. Percolation experiments were conducted on the TOSCO spent shale and the quantities of dissolved solids leachable determined. The concentrations of the various ionic species in the initial leachate from the column were high. The major constituents, SO equal to 4 and Na plus, were present in concentrations of 90,000 and 35,000 mg/l in the initial leachate; however the succeeding concentrations dropped markedly during the course of the experiment. A computer program was utilized to predict equilibrium concentrations in the leachate from the column. The extent of leaching and erosion of spent shale, and the composition and concentration of natural drainage from spent shale has been determined using oil shale residue and simulated rainfall. Concentrations in the runoff from the spent shale have been correlated with runoff rate, precipitation intensity, flow depth, application time, slope, and water temperature. (EPA abstract)
W72-04556

SIMULTANEOUS QUANTITATION OF SALMONELLA SPECIES AND PSEUDOMONAS AERUGINOSA. II. PERSISTENCE OF PATHOGENS IN SLUDGE TREATED SOILS,
National Environmental Research Center, Cincinnati, Ohio.
B. A. Kenner, G. K. Dotson, and J. E. Smith.
September 1, 1971. Second of three papers, 36 p. Paper II, 2 tab, 8 ref.

Descriptors: Agriculture, *Pathogenic bacteria, *Salmonella, *Pseudomonas, *E. coli, *Public health, *Diseases, *Ultimate disposal, Persistence, *Sludge disposal, Soil treatment, Sewage treatment, Pennsylvania, Ohio, Municipal wastes.
Identifiers: St. Marys (Pennsylvania), Penn Township (Pennsylvania), Cincinnati (Ohio).

The persistence of Salmonella species, Pseudomonas aeruginosa, and fecal coliforms in soils treated with various types of municipal sludges is reported. The initial studies were made on sludge-treated soils in Pennsylvania under relatively mild spring and summer conditions. The second series of studies was made employing municipal sludges from Cincinnati sewage treatment plants and under more severe late fall and winter conditions. From results obtained testing relatively small soil samples at weekly intervals, it is evident that sludge-borne pathogens may persist on agricultural or grass lands in the top two inches (5 cm) of soil for at least 21 weeks. The use of unsterile municipal waste treatment sludges on land may well contribute to uninterrupted human and animal disease cycles. (EPA abstract)
W72-04560

PLANT NUTRIENTS AND ANIMAL WASTE DISPOSAL,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 05C.
W72-04573

THE FEASIBILITY OF OBTAINING A SOLID DRY BRINE EFFLUENT FROM DESALTING PLANTS AT INLAND LOCATIONS,
Struthers Energy Systems, Inc., Warren, Pa.
For primary bibliographic entry see Field 03A.
W72-04576

UTILIZATION OF AGRICULTURAL WASTES,
Agricultural Research Service, University Park, Pa.
For primary bibliographic entry see Field 05D.
W72-04622

WASTE HANDLING ALTERNATIVES,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05D.
W72-04624

WASTE MANAGEMENT ON A MODERN DIARY FARM,
For primary bibliographic entry see Field 05D.
W72-04627

FOOD PROCESSING WASTEWATER TREATMENT,
Harnish and Lookup, Assoc., Newark, N.Y.
For primary bibliographic entry see Field 05D.
W72-04629

RENOVATION OF TREATED MUNICIPAL SEWAGE EFFLUENT AND DIGESTED LIQUID SLUDGE THROUGH IRRIGATION OF BITUMINOUS COAL STRIP MINE SPOIL,
Pennsylvania State Univ., University Park. Dept. of Forestry and Wildlife.
For primary bibliographic entry see Field 05D.
W72-04634

GROUND-WATER POLLUTION AND SANITARY LANDFILLS--A CRITICAL REVIEW,
Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W72-04654

5F. Water Treatment and Quality Alteration

DIATOMITE FILTRATION FOR REMOVAL OF IRON AND MANGANESE,
Massachusetts Dept. of Public Health, Lawrence.
G. J. Coogan.

Journal of the American Water Works Association, Vol 54, No 12, p 1507-1517, December 1962. 6 fig, 4 tab, 8 ref.

Descriptors: *Water treatment, *Filtration, *Diatomaceous earth, *Iron, *Manganese, Chlorine, Lime, Sodium compounds, Phosphates, *Filters.
Identifiers: Hypochlorites, Filter aids, *Diatomite filters.

Ground water is a mjaor source of supply in Massachusetts. Iron and manganese in the water often means that it must be treated, otherwise the wells must be abandoned. Concentration often increase with continued use, especially when demands cause increases in draft from the wells. Slow sand filtration has generally been unsatisfactory with waters containing large amounts of iron and manganese because of filter clogging. An integrated program of iron and manganese removal research was undertaken and a pilot plant with a vacuum diatomite filter and a pressure diatomite filter was designed to carry out the study. Studies were carried out at Amesbury where iron content varied from 6. to 11. ppm and manganese from 0.25 to 0.45 ppm, at Lowell with average iron of 4.0 ppm and manganese of 1.3 ppm, and at Billerica with average iron of 6 mg/l and manganese 1.3 ppm. Studies included use of sodium hypochlorite, calcium hypochlorite, chlorine, limestone, hydrated lime soda ash, copper sulfate, potassium permanganate, trisodium phosphate, various grades of diatomaceous earth and various pH ranges. At Amesbury 90% of samples of finished water contained less than 0.2 ppm of iron, and 50% less than 0.02 ppm. At Lowell, iron in finished water for 95% of samples was less than 0.1 ppm. Manganese was reduced effectively above pH 8.5 but only about one-half could be removed at pH below 8.0. (Bean-AWWA)
W72-04136

RELATIONSHIP BETWEEN WATER QUALITY AND DEATHS FROM CARDIOVASCULAR DISEASE,
City Univ. of New York.
D. L. Muss.
Journal of the American Water Works Association, Vol 54, No 11, p 1371-1378, November 1962. 2 fig, 3 tab, 11 ref.

Descriptors: *Water purification, *Public health, *Water quality, *Disease, *Calcium, *Magnesium, *Hardness (Water), United States.
Identifiers: *Cardiovascular disease, *Vanadium.

Cardiovascular disease accounts for nearly 50% of all deaths in the U.S. Present are 1949-51 data, for each of the States, on the average annual age-adjusted death rates from cardiovascular disease. From regression analysis of this data it appears that, both on a national and local scale, the presence of calcium or magnesium-or other substances normally present or absent when calcium or magnesium is present-are responsible for substantial reductions in the death rates from cardiovascular disease. William H. Strain has prepared a hypothesis to explain the correlation between vanadium and death rates from cardiovascular disease. Vanadium is absent in coastal waters where cardiovascular disease death rates have been high and it is present in hard waters where they are lower. Strain explains his hypothesis on the basis of studies indicating that vanadium inhibits the manufacture of cholesterol and phospholipids. Thus vanadium in hard waters might prevent or retard the build up of these substances in the arteries. (Bean-AWWA)
W72-04138

EFFECTIVENESS OF WATER UTILITY QUALITY CONTROL PRACTICES,
Public Health Service, Washington, D.C. Div. of Environmental Engineering and Food Protection.
For primary bibliographic entry see Field 05G.
W72-04140

DETECTION AND ENUMERATION OF IRON BACTERIA IN MUNICIPAL WATER SUPPLIES,
Wisconsin State Commission on Water Pollution, Madison.
For primary bibliographic entry see Field 05A.
W72-04143

LABORATORY AND FIELD STUDIES ON THE TREATMENT OF IRON-BEARING WATERS,
Illinois Univ., Urbana. Dept. of Civil Engineering.
J. M. Longley, R. S. Engelbrecht, and G. E. Margrave.
Journal of the American Water Works Association, Vol. 54, No. 6, p 731-745, June 1962. 6 fig, 2 tab, 17 ref.

Descriptors: *Water treatment, *Iron, *Stability, *Aeration, *Filtration, Hydrogen ion concentration, Illinois.

The presence of iron in many water supplies is a problem. 70% of the raw-water supplies of Illinois contain iron in excess of 0.3 ppm. Data indicate that 33% of plants with iron removal facilities are not reducing the iron content to a satisfactory level. A joint investigation is being carried out by the Sanitary Engineering Laboratory of the Univ. of Illinois and the Illinois Dept. of Public Health. A pilot plant, designed for both laboratory and field experiments is described and initial experiments and conclusions are presented. Satisfactory synthetic iron-bearing waters can be prepared. The pilot plant (0.12 gpm) consisting of an aerator, reaction basin, and sand filter appears to be applicable in studying iron removal both in the laboratory and at field sites. During storage, water with alkalinity values greater than the total hardness were less stable toward ferrous iron than water with non-carbonate hardness and lower pH; ferrous iron was more stable in waters having a high carbon dioxide content. Iron removal by aeration was 0.1 to 44%, by reaction basin 0 to 13%, by filtration 96 to 100%. Chlorides, sulfates, hardness, nitrogen and chemical oxygen demand, in the limits studied, had no effect on over-all iron removal efficiency. (Bean-AWWA)
W72-04144

EXPERIENCES WITH MUNICIPAL DIATOMITE FILTERS EXPERIENCES IN NEW YORK,
New York State Dept. of Health, Lathan.
G. W. Moore.
Journal of the American Water Works Association, Vol. 54, No. 12, p 1500-1504, December 1962. 3 tab.

Descriptors: *Water treatment, *Turbidity, *Iron, *Manganese, *Color, *Algae, *Colloids, Flow rates, *Filters, *New York, Treatment facilities.
Identifiers: *Diatomite filters, Filter aids.

Experiences at the various diatomite filter installations in N.Y. are reviewed, and the N.Y. State Health Department's position regarding diatomite filtration is summarized. In general diatomite filters should be considered as finishing filters where the water is not heavily polluted, the average turbidity is 10 or less, and maximum turbidity does not exceed 30 for any appreciable time. They should be approved only if pretreatment is included where there is a problem of iron removal, fixed color, heavy algae laoding, or turbidity is in fine suspension or colloidal form. At least two units should be provided. Permissible rate of filtration should depend upon the character of the raw water and the degree or type of supervision and laboratory control. The normal filter rate should be 1 gpm/sq ft. Either horizontal or vertical elements are acceptable, also pressure or vacuum types. The diatomite used should be acceptable to the reviewing authority. (Bean-AWWA)
W72-04145

EFFLUENT QUALITY CONTROL AT A LARGE OIL REFINERY,
Weston (Roy F.), Inc., West Chester, Pa.
For primary bibliographic entry see Field 05D.
W72-04146

EXPERIENCES WITH MUNICIPAL DIATOMITE FILTERS-EXPERIENCES IN MICHIGAN,
Michigan Dept. of Health, Lansing. Water Supply Section.
T. L. VanderVelde, and C. C. Crumley.
Journal of the American Water Works Association, Vol. 54, No. 12, p 1493-1500, December 1962. 3 fig, 3 tab.

Descriptors: *Water treatment, *Diatomeceous earth, *Design, *Filtration, *Operations research, Electrolytes, Flow rates, Instrumentation, *Filters, Michigan, Treatment facilities.
Identifiers: *Diatomite filters.

Satisfactory diatomite filter runs prevail at turbidities under 5 units at conventional filter rates. Short filter runs prevail for turbidities above 5 units and result in significant operating problems. Adequate instrumentation, recorders, and close supervision by the operator are essential for operational control. Controlled field investigations should be conducted and should include studies to determine: (1) the optimum continuous slurry feed for various water quality conditions; (2) types of filter aid best suited for various raw-water qualities; (3) filter runs for constant rates and decreasing rates for constant heads; and (4) effectiveness of pretreatment. Additional research and improvements are indicated for filter element design, continuous slurry feed system design, backwashing facilities and techniques, and overall filter design with attention to precoat and slurry application. Finally, actual operation has demonstrated the need for storage following filtration. (Bean-AWWA)
W72-04150

USE OF POTASSIUM PERMANGANATE IN WATER TREATMENT,
Cedar Rapids Water Works, Iowa.
A. K. Cherry.
Journal of the American Water Works Association, Vol. 54, No. 4, p 417-424, April 1962. 1 fig, 1 tab.

Descriptors: *Water treatment, *Algae, *Actinomycetes, *Odor, Activated carbon, Ammonia, Chlorine.
Identifiers: *Potassium permanganate.

Threshold odors of raw water, normally under 200, rose to an average of 896 in July with a maximum one day of 4,000. Algae count averaged 48,600 per ml. Average permanganate dosage was 10.1 ppm, and carbon application 51 ppm. Finished water odors were as high as 14-18. The most successful treatment was discontinuance of softening and the application of permanganate at the intake, permitting it to pass through the primary mixers and clarifiers without adding other chemicals. Alum was applied in the secondary mixers, with lime for pH adjustment. Carbon was applied as the water passed to the final clarifiers. Ammonia and chlorine application was changed to the clear well after filtration. By this treatment, odor was reduced from 400-2,000 to 3-5 in finished water. The abnormally large number of known odor producing algae was assumed to be the principal cause of the undesirable tastes and odors, however, part of the odors could be traced to actinomycetes. (Bean-AWWA)
W72-04155

RESEARCH NEEDS, PRIORITIES, AND INFORMATION SERVICES,
American Water Works Association, New York. Committee on Research.
T. E. Larson.
Journal of the American Water Works Association, Vol. 54, No. 6, p 657-664, June 1962. 1 ref.

Descriptors: *Water treatment, *Public health, *Research and development, *Chemical reactions, Coagulation, Flocculation, Oxidation, Aluminum compounds, Iron.

Identifiers: Coagulant aids.

Under 'Source of Supply' 21 questions needing research are listed, and under 'Transmission and Distribution' about a dozen. Improved management research also is needed. The question is not, where is research needed. It is, how soon can support for needed research be provided. With respect to treatment methods, no analytical procedure is immune to scrutiny as to accuracy, sensitivity, simplicity and adaptability to recording. The chemistry of alum in water has yet to be established. A good method to determine floc strength to evaluate the coagulation step has yet to be devised. Significant studies are needed on the coagulant aids; a thorough knowledge of the chemicals and processes is needed. The solubility of alum at other than 18 and 25 C is not known though it is being used at near-zero temperatures. Iron removal is a very inconsistent water treatment process - why Rates of oxidation have not been researched. Inhibitors have not been defined. How can organics be removed from water. What organics besides alkylbenzene sulfonates slip through waste treatment plants. What is known about the minor elements of radioactivity in water and their effects on consumers. (Bean-AWWA)
W72-04156

A THEORY OF DIATOMITE FILTRATION,
Iowa State Univ., Ames. Dept. of Civil Engineering.
E. R. Baumann, J. L. Cleasby, and R. L. LaFrenz.
Journal of the American Water Works Association, Vol 54, No. 9, p 1109-1119, September 1962. 9 figs, 1 tab, 9 ref.

Descriptors: *Water treatment, *Diatomaceous earth, *Filtration, Treatment facilities, *Theoretical analysis, Head loss.
Identifiers: *Diatomite filters, Coagulant aids, Pilot plant.

It would be advantageous to find a relationship connecting the filtering characteristics of the suspended solids, body feed, and filtration rate with the filter cake head loss in a diatomite filter after filtering a given amount of water. The various steps in a pilot plant study to construct a complete equation incorporating all factors are reported, with an equation, which contains two unknowns. K3 is a constant which depends on the grade of diatomite and the water to be filtered. K4 is a function of the suspended solids to be removed and is related to the ratio of suspended solids to body-feed diatomite in the filter cake. K3 can be reported by filter-aid manufacturers. Values of K4 can be determined in about 4 or 5 filtration tests. (Bean-AWWA)
W72-04161

SELECTION OF SAND FILTRATION RATES,
Iowa State Univ., Ames. Dept. of Civil Engineering.
J. L. Cleasby, and E. R. Baumann.
Journal of the American Water Works Association, Vol 54, No 5, p 579-602, May 1962. 15 fig, 5 tab, 29 ref.

Descriptors: *Water treatment, *Filtration, *Flow-control, Standards, Pathogenic bacteria, Head loss.

A three-year study of filtration was conducted utilizing pilot sand filters 6 inches I.D., 53 in. long. Factors to be considered in selecting design filtration rate include the consequences of higher rates in terms of quality, filter run length, and percentage of product used in backwashing. Sand filters pass some material at all filtration rates. Use of standard rates does not assure good quality. Higher rates may result in worse water quality, the change may be insignificant. Therefore, the proper role of filtration is to serve as a polishing step to assure acceptable effluent clarity. It cannot be relied upon as a final pathogen control. In the filtration of suspensions that cause head loss to develop at an increasing rate as the filter run progresses, greater production per run can be expected as rates are increased. The increasing rate of head loss development associated with an optimum-rate tendency is caused by development of a compressible surface cake on the sand surface, which only occurs when particles in suspension have adequate internal strength to resist the hydraulic shear forces tending to drag them down into the filter. At the optimum rate of filtration, the surface cake influence has been minimized and the head loss development approaches linearity. (Bean-AWWA)
W72-04216

USE OF IODINE FOR DISINFECTION,
Florida Univ., Gainesville. Dept. of Chemistry.
A. P. Black, R. N. Kinman, W. C. Thomas, Jr., G. Freund, and E. D. Bird.
Journal of American Water Works Association, Vol 57, No 11, p 1401-1421, November 1965. 18 fig, 9 tab, 24 ref.

Descriptors: *Water treatment, *Public health, *Disinfection, Color, Taste, Odor.
Identifiers: *Iodine, Thyroid.

The use of iodine as disinfectant for the water supplies of 700 people was studied over a period of 19 months. The iodine was extremely effective for disinfection; residuals were maintained in the distribution systems; and in doses of 1.0 ppm, iodine produced no discernible color, taste or odor in water. A variety of medical and physiologic tests, including indices of thyroid function, were made on 70 subjects receiving the iodized water. No evidence of any detrimental effect on general health or thyroid function developed. The relatively high cost of iodine is offset by the low chemical reactivity which results in low iodine demands. Also little or no iodine is lost by iodate formation. Disinfecting residuals may be maintained to the extremities of distribution systems by use of a slow-acting oxidizing agent, such as monochloramine. (Bean-AWWA)
W72-04217

COAGULATION TESTING: A COMPARISON OF TECHNIQUES- PART II,
Montgomery Research Inc., Pasadena, Calif.
R. J. TeKippe, and R. K. Ham.
Journal of the American Water Works Association, Vol 62, No 10, October 1970, p 620-628. 17 fig, 1 tab, 38 ref.

Descriptors: *Water treatment, *Coagulation, *Control, Comparative benefits, Analytical techniques, Settling velocity.
Identifiers: Floc volume, Floc size, Colloid titration, Jar tests, Membrane filtration.

Twenty techniques for design and control of the coagulation process have been considered and discussed. From this list, settled and filtered jar test turbidity reduction, floc formation time, visual floc size comparisons, membrane refiltration, colloid titration, settleable floc volume, pilot plant filtration, and electronic counting particle were selected for laboratory experimentation. These techniques appear to fall into three general categories, colloid titration, conventional and modified jar tests and membrane and pilot plant filtration. This study reaffirmed that the effects and interactions of the chemical variables affecting colloidal particle destabilization in water treatment are very complex. Many of the different coagulation control techniques measure essentially the same properties of a suspension. Of the coagulation control techniques tested, the settled turbidity jar test technique was found to be of the most practical value for evaluating the settleability of a coagulated suspension. However, the electronic counting technique does give a nearly comparable indication of settleability and can measure other floc properties simultaneously. The membrane refiltration technique is simple and, when used judiciously, can give information on particle filterability comparable to the more laborious technique of pilot plant operation. (Goessling-Texas)
W72-04218

BEHAVIOR AND EVALUATION OF MICROSTRAINING FOR A SUPPLY IN CALIFORNIA,
Engineering-Science Inc., Oakland, Calif.
R. C. Carter, H. F. Ludwig, H. J. Ongerth, J. A. Harmon, and S. H. Woody, II.
Journal of the American Water Works Association, Vol 54, No 5, p 606-620, May 1962. 4 fig, 6 tab, 5 ref.

Descriptors: *Water treatment, *Turbidity, *Plankton, *Coliforms, *Slime, *Fungi, *Ultraviolet radiation.
Identifiers: *Microstraining.

The installation of 10 ft X 10 ft microstrainer, the method developed to evaluate its performance and the results obtained are described. It was installed at Lytle Creek which has a drainage area of 45 sq. mi on the southerly slope of the San Bernardino Mountains. For short periods there are significant increases in turbidity. Also the normal stream load includes vegetation particles, insect parts and plankton. Traveling screens (16 mesh) just in front of the microstrainer carry off the leaves, twigs and other gross materials. The unit has generally operated at rates of 2-5 MGD. It has operated to 11 MGD, but was designed for 5 MGD. Particles bound with bacterial slimes and fungus mycellium caused increased head losses through the screens. Ultraviolet lamps, specially selected not to emit ozone which would corrode the screen, effectively destroyed the slime. Data indicate that some coliforms are removed, probably through adherence or inclusion in the particulates. Microstraining reduced the volume of particulates by an average of 64%. The coefficient of variation for the volume was reduced from 2.1 to 1.3. Chlorine demand was reduced by approximately 33%. For the Lytle Creek supply, microstraining was effective in removal of objectionable particulates, especially those likely to cause consumer complaints. (Bean-AWWA)
W72-04223

DESIGN AND APPLICATION OF MULTIMEDIA FILTERS,
Neptune Microfloc, Inc., Corvallis, Oreg.
W. R. Conley, and H. Kou-ying.
Journal of the American Water Works Association, Vol 61, No 2, p 97-101, February 1969. 4 fig, 5 tab, 13 ref.

Descriptors: *Water treatment, *Filters, *Filtration, *Design, Flocculation, Electrolytes.
Identifiers: *Dual-media filters.

Alternative filter designs using media of different specific gravities and sizes have been built and tested on various kinds of raw water supplies. Some of these data and operating results from various plant designs are presented and discussed. A practical rational method to optimize design, developed for uniform single media filters can also be used for filters made of three or more non-uniform and different materials. Polyacrylamides drastically change the filter performance for all filters tested and should be considered in filter design. Filter design should not be limited by rule of thumb standards and should be specific to individual water sources. Operating results of many plants show that custom design for specific situations is reasonable. Flocculation within filter pores may be important and needs to be re-evaluated. (Bean-AWWA)
W72-04234

CHEMICAL CHARACTERIZATION OF A PUBLIC WATER SUPPLY,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 05A.
W72-04235

STATUS OF FLUORIDATION IN NEW YORK STATE,
New York State Dept. of Public Health, Albany. Div. of Pure Waters.
W. Berner.
Journal of the American Water Works Association, Vol 61, No 2, p 68-72, February 1969. 5 fig, 4 tab, 5 ref.

Descriptors: *Water treatment, *Public Health, *Fluoridation, *Fluorides, Costs, New York.
Identifiers: *Hydrofluosilicic acid.

The first fluoridation of a water supply in New York State was at Newburgh in 1945; this was the only installation offering fluoridation in that state until 1951. In 1956 only 25 public supplies were fluoridated; this increased to 70 in 1967. These 70 public supplies serve 353 communities and water districts; almost 11 million people, or approximately 70 percent of the population on public supplies in New York State. The City of New York began fluoridation in 1965, thereby adding nearly 8 million persons, and more than tripling numbers served with fluoridated water. New systems of the past dozen years have utilized hydrofluosilicic acid, and six systems have changed from dry materials to the acid. Twice as many supplies utilize the liquid, and they serve four times as many consumers since New York City is one of those utilizing the acid. Average per capita cost is 16 cents per year with a range of 6 to 33 cents, according to the decreasing population served. (Bean-AWWA)
W72-04236

MECHANISM OF VIRUS ADSORPTION ON ACTIVATED CARBON,
Maryland Univ., College Park. Dept. of Civil Engineering.
J. T. Cookson, Jr.
Journal of the American Water Works Association, Vol 61, No 1, p 52-56, January 1969. 8 fig, 1 tab, 16 ref.

Descriptors: *Water treatment, *Viruses, *Activated carbon, *Adsorption, Hydrogen ion concentration, Water purification, Disinfection, *Bacteriophage.
Identifiers: *Esterification, Electrostatic forces, Carboxyl group, Ionic strength.

Sites on activated carbon that adsorb bacteriophage T4 are probably a carboxyl group or lactone. Adsorption on carbon can be completely blocked by esterifying these groups. It is proposed that amino groups on the virus adsorb to carboxyl groups on the carbon by electrostatic attraction. As pH decreases from the optimum of 7, adsorption rate decreases, presumably resulting from an increase of negative charge on the virus particles and carbon surface, causing greater repulsive forces between the viruses and carbon particles. The collision frequency, therefore is reduced. With increasing ionic strength, adsorption is aided as like charges on the virus and carbon particles are masked; at the same time, repulsive forces between the viral tail fibers and tail sheath are reduced. With the increasing ionic strength, more and more tail fibers adsorb on the tail sheath. Although high ionic strengths cause a maximum collision frequency between virus and carbon particles, the adsorbing tail fibers become less available. These mechanisms are supported by equilibrium studies at high and low ionic strenths. (Bean-AWWA)
W72-04237

PHYSICAL ASPECTS OF FILTRATION,
Hazen and Sawyer, New York.
H. E. Hudson, Jr.
Journal of the American Water Works Association, Vol 61, No 1, p 3-7, January 1969. 6 fig, 3 tab, 21 ref.

Descriptors: *Water treatment, *Water quality, *Filtration, *Flocculation, Head loss, Hydraulic gradient, Filters.
Identifiers: Dual-media filters.

Behavior of the traditional rapid sand filter is discussed, then dual-media filter beds and higher rates of filtration. Methods of studying the behavior of filters are also discussed. Early in the filter run, flocculated suspended matter is removed near the top of the bed. Later removal occurs at greater depths, but this removal is by an attachment process more than by shearing and transport of previously deposited material. While floc removal is proceeding the already removed floc becomes more compact. Within a bed of 0.5 mm sand, strong floc can tolerate hydraulic gradients of 50 or more feet of water per foot of bed depth, but weak flocs penetrate with gradients of 12 or less. Care is still required in the design of multimedia beds. A size and thickness selection for the overlying coarse layer that always gives long filter runs may endanger water quality when floc is weak by overloading the deeper fine material. (Bean-AWWA)
W72-04238

QUALITY GOALS FOR POTABLE WATER; STATEMENT OF POLICY.
American Water Works Association, New York. Water Quality Goals Task Group.

Journal of the American Water Works Association, Vol 60, No 12, p 1317-1322, December 1968. 1 tab.

Descriptors: *Water quality, *Standards, *Public health, *Water treatment.
Identifiers: *Quality goals.

A Statement of Policy of the American Water Works Association as to the Goals of Quality which the industry should be striving to meet; goals which can generally be met by careful and proper application of modern technology where adequate facilities are available. These are not Standards, these Goals indicate far finer quality water than can be legally justified as minimum requirements for protection of health. They represent a truly high quality product, pleasing to consumers. (Bean AWWA)
W72-04239

STATUS OF FLUORIDATION IN THE UNITED STATES AND CANADA, 1966.
American Water Works Association, New York. Water Fluoridation Committee.

Journal of the American Water Works Association, Vol 60, No 10, p 1199-1204, October 1968. 1 fig, 8 tab.

Descriptors: *Water treatment, *Public health, *Fluoridation, Fluorides, United States.
Identifiers: Canada.

At the end of 1966 there were 3,145 communities in the U.S. and 277 in Canada using controlled fluoridation, serving populations of 62,400,000 and 4,960,000. This represents an increase from 1965 of 4.3 percent in the U.S. and 5.1 percent in Canada. New York City adopted fluoridation in 1965, making the third system serving over 1 million people. During the past five years the number of persons using fluoridated water has increased by 20 million; during the previous five years the increase was 8.3 million. Counting the 10 million persons using naturally fluoridated water, about 72 million persons in the United States are drinking water containing fluorides in amounts effective for reducing dental cavities. In the period 1950-1966 Referenda on Fluoridation in the U.S. have numbered 952, of which 566 won approval. During 1965 Connecticut enacted a law requiring all communities of more than 20,000 persons to fluoridate. In 1966, Minnesota enacted a law requiring all public water supplies to fluoridate by Jan. 1, 1970. In July 1966, Kentucky adopted a health department regulation requiring that all communities having more than 3,000 persons adopt fluoridation; for otherwise, the supply would be downgraded. Similar laws or regulations are being considered by Michigan and Illinois. (Bean-AWWA)
W72-04240

REACTIONS OF METAL IONS IN DILUTE AQUEOUS SOLUTION: HYDROLYSIS OF ALUMINUM,
Florida Univ., Gainesville, Dept. of Environmental Engineering.
J. H. Sullivan, Jr., and J. E. Singley.
Journal of the American Water Works Association, Vol 60, No 11, p 1280-1287, November 1968. 11 fig, 6 ref.

Descriptors: *Water treatment, *Aluminum, *Hydrolysis, Metals, Computers, Hydrogen ion concentration, *Aqueous solutions, Ions.
Identifiers: *Complexing anions, *Metal ions.

Experimental data are presented on various titration curves, a system model is developed, and concentration quotients computer programs for determination of Q values, computer fit for n and pH curves, and calculation of species present are discussed. The hydrolysis of aluminum ion in dilute, aqueous solution, in the absence of complexing anions other than hydroxide, was studied. The data for 1 x 10 .001M and 1 x 10 .0001M solutions of aluminum can be explained by a model requiring only mononuclear species. There is no evidence for a species having an aluminum to hydroxide ratio of 1:2.5 under the conditions studied. The predominant species up to pH 4.5 was Al+++, from pH 4.5 to 8 it was Al (OH)3 and above pH8 it was Al (OH)4 (-). (Bean-AWWA)
W72-04241

ODOR CONTROL WITH CARBON AND PERMANGANATE AT DES MOINES,
Des Moines Water Works, Iowa.

Journal of the American Water Works Association, Vol 60, No 10, p 1195-1198, October 1968. 2 tab.

Descriptors: *Water treatment, Odor, *Algae, *Decomposing organic matter, *Potassium compounds, *Activated carbon, Actinomycetes, Iowa.
Identifiers: *Potassium permanganate, *Des Moines (Iowa).

At periods during the year the threshold odor of the water supply at Des Moines rose to levels causing widespread complaints of consumers. These odors are typically earthy or musty in character. Industrial waste or domestic sewage contamination are not problems in the Raccoon River an occasional source of raw water for Des Moines. The odors result from growth of algae or washing of extracts from decayed vegetation. Actinomycetes have been isolated with the same odor characteristics as the river water. Potassium permanganate is a valuable adjunct to the normal feed of activated carbon during periods of river intake; when the threshold odor of the Raccoon River exceeds 25, potassium permanganate is fed. At threshold odor levels below 25, either material will produce satisfactory water, and the choice is primarily one of convenience. (Bean-AWWA)
W72-04242

UPFLOW FILTRATION PROCESS,
Black and Veatch, Kansas City, Mo.
C. L. Hamann, and R. E. McKinney.
Journal of the American Water Works Association, Vol 60, No 9, p 1023-1039, Sept. 1968. 9 fig, 1 tab, 37 ref.

Descriptors: *Water treatment, *Filtration, *Sedimentation, Filters, Treatment facilities.
Identifiers: *Upflow filtration, *Biflow filtration.

Upflow filtration and its advantages over conventional downflow operation are discussed. 'Biflow' filtration is described. In biflow filtration, water is introduced to the filter at both the top and bottom of the bed at the same time; the filtrate is collected at some intermediate level within the media by a suitable drainage system. Increasing the depth of

sand in the upflow filters produced better results, with fewer problems of bed upset. Use of a grid at the top of the media resulted in longer upflow filter runs and better solids removal capability. Use of compressed air was necessary during backwashing of the upflow filters to clean the lower layers of sand and gravel. Upflow filtration has a definite advantage over gravity sand filtration due to use of the entire bed for removal of suspended matter. Capacity for storage of solids is such that conventional flocculation, sedimentation, and filtration could, in some cases, be replaced by upflow filtration. The biflow filtration process appears to combine the advantages of both the upflow and the conventional gravity filter. Further research is needed to demonstrate the advantages of this process. (Bean-AWWA)
W72-04244

A SIZE-DENSITY RELATIONSHIP FOR FLOCS,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
A. L. Lagvankar, and R. S. Gemmell.
Journal of the American Water Works Association, Vol 60, No 9, p 1040-1046, September 1968. 6 fig, 6 ref.

Descriptors: *Water treatment, *Flocculation, *Filtration, *Mixing, *Density, *Strength, Iron compounds, Computer.
Identifiers: *Ferric sulfate, *Velocity gradient, Polyelectrolytes.

Flocculators should be designed to generate particle aggregates in such a way that the settling characteristics and filterability of the suspension are improved. The literature provides little information on the density of flocs encountered in water treatment practice, or on the effects of different flocculating procedures on these densities. Even less is known about the dependence of floc density upon floc size. The Vold computer model for floc formation by random conjunction of primary particles is discussed also, floc density vs size and velocity gradients in mixing. Intensity of agitation alters the size-frequency distribution and thereby the density characteristics of the suspension. Polyelectrolytes, used in small concentrations along with ferric sulfate, do not alter floc densities, size-for-size. They do increase floc strength as indicated by the observation that larger flocs were formed when they were used. (Bean-AWWA)
W72-04245

EXPERIENCES WITH MICROSTRAINING AT ILION,
Stearns and Wheeler, Cazenovia, N.Y.
W. O. Lynch, C. R. Baker, and J. H. Haberer.
Journal of American Water Works Association, Vol 57, No 11, p 1422-1430, November 1965. 2 tab 3 ref.

Descriptors: *Water treatment, *Microstraining, *Filtration, Diatomaceous earth, Flow rates, Costs, New York, Filters, Treatment facilities.
Identifiers: *Slow sand filtration, Filter aids, Diatomite filters, *Ilion (NY).

The Ilion plant used microstrainers preceding slow sand filtration on a soft water. Microstraining reduced living organisms in the water by 75 percent. After adoption of the microstraining, water production rate on the filters increased by 40 percent, and comparable quantities of water have since been produced with 28 percent less filter area. After adoption of microstraining, dirt penetrated deeper into the beds - possibly because removal of the algae etc. reduced the zoogleal layer at the surface. This penetration was stopped by coating the sand surface after each skimming or resanding with 1 lb. diatomite per 10 sq. ft., at a cost of $315 per acre. Net cost of skimming the filters has been reduced by the microstraining by $2,600 per year because of the reduced number of skimming. Economically, use of the diatomaceous earth on top of the slow sand filters is fully justified. (Bean-AWWA)
W72-04246

MICROBIAL CONSIDERATIONS IN DRINKING WATER,
National Center for Urban and Industrial Health. Cincinnati, Ohio.
P. W. Kabler.
Journal of the American Water Works Association, Vol 60, No 10, p 1173-1180, Oct. 1968. 37 ref.

Descriptors: *Water treatment, Water quality, *Public health, *Diseases, *Pathogenic bacteria, *Viruses, *Coliforms, Chlorine.
Identifiers: Fecal coliforms.

Pathogenic enteric bacteria can be readily isolated from many polluted surface waters. One or more types of enteric viruses can sometimes be isolated from polluted surface waters, especially in the late summer and fall. Pathogenic bacteria and viruses survive in water for a few days to several weeks. Chemical flocculation, sedimentation, and filtration when properly applied remove 95-99.99 percent or more of the bacterial and viral content of the water. Different types of enteric viruses vary widely in their resistance to free chlorine. Combined chlorine is considerably less germicidal than free chlorine and requires higher concentrations or longer contact periods to achieve comparable inactivation. Fecal coliform organisms may be considered indicators of recent fecal pollution. Under unusual conditions, where the raw water supply contains large amounts of sewage or where there have been mechanical or human failures in water treatment plant operation, water-borne disease may result. Under normal conditions of raw-water supply and of adequate treatment plant operation in this country, however, the pathogenic bacterial and virus content in drinking water is below the infectious level when the Standard Methods Coliform test shows no gas in any tube. The paucity of water-borne disease outbreaks supports this view. (Bean-AWWA)
W72-04247

THE CHEMISTRY OF HIGH-RATE WATER TREATMENT,
Roberts Filter Mfg. Co., Darby, Pa.
J. W. Moffett.
Journal of the American Water Works Association, Vol 60, No 11, p 1255-1270, November 1968. 5 fig, 40 ref.

Descriptors: *Water treatment, *Zeta potential, *Hydrogen ion concentration, *Coagulation, *Design, Mixing, Flow rates.
Identifiers: *Chemical control, *Detention time, Velocity gradient.

Plant designs are generally based on such physical parameters as flow rates, detention time, velocity gradients, and media particle size. There is no known relationship between these physical design parameters and the chemical properties of the impurities in the raw water or of the coagulant floc. The state of the art in plant design would seem to indicate that plant operation is independent of all chemical aspects. The most important step in water purification is coagulation, which takes place in the rapid mixer. If the operator consistently controls the coagulation process at the optimum pH and zeta potential, the plant will operate at the height of its effectiveness and efficiency. Process design features, chemical control, and operational suggestions are discussed in great detail. (Bean-AWWA)
W72-04248

HIGH-ENERGY FLOCCULATION UNITS,
Walker Process Equipment Corp., Aurora, Ill.
J. D. Walker.
Journal of the American Water Works Association, Vol 60, No 11, p 1271-1279, November 1968. 6 fig, 9 ref.

Descriptors: *Water treatment, *Flocculation, *Mixing, Mechanical equipment, Treatment facilities.
Identifiers: *High-energy units, *Velocity gradients.

Mechanical means for achieving varying degrees of fine scale turbulence for flocculation can be rated by the average velocity gradient effect as calculated from the water horsepower dissipated. Not all devices apply velocity gradients uniformly, and this nonuniformity is apt to be magnified when greater velocity gradients are attempted. To control short-circuiting of throughputs, successive compartments are indicated. Such compartmentization will allow tapering of velocity gradient to use greater than traditional gradients in the formulative phases of floc building. Variable speed drives will allow selectively choosing the velocity gradients best suited. A special axial-flow flocculation unit was tested which is capable of yielding uniformly distributed small eddies over a great range. (Bean-AWWA)
W72-04249

SIMULTANEOUS PLANT-SCALE TESTS OF MIXED MEDIA AND RAPID SAND FILTERS,
Forrest and Cotton, Inc., Dallas, Tex.
J. E. Laughlin, and T. E. Duvall.
Journal of the American Water Works Association, Vol 60, No 9, p 1015-1022, September 1968. 6 fig.

Descriptors: *Water treatment, Water quality, *Filtration, *Flow rates, *Head loss, Monitoring, Filters, Texas.
Identifiers: *Mixed-media filters, *Pilot filters, *Greenville (Tex).

At Greenville, Texas two of four conventional rapid sand filters were converted to mixed-media units. Additional control and monitoring equipment was added. A series of investigations of the operations of both filter systems was undertaken in 1966 and 1967. Mixed-media beds have longer filter runs to a given head loss. A clearer effluent is produced in mixed beds. The new media can operate at a nominal filter rate of 5 gpm/sq ft, and a peak rate of 8 gpm/sq ft. In emergencies, the filters can produce 10 gpm/sq ft. Mixed-media beds require less wash water. Improved control equipment, including a pilot filter for optimizing coagulant dosage, accompanies conversion to mixed media and improves overall plant performance. For a minimal cost, nominal plant capacity can be increased 150 percent and peak capacity 100 percent. (Bean-AWWA)
W72-04251

OPERATION AND MAINTENANCE OF RAPID SAND AND MIXED-MEDIA FILTERS IN A LIME SOFTENING PLANT,
Saint Louis County Water Co., University City, Mo.
J. L. Tuepker, and C. A. Buescher.
Journal of the American Water Works Association, Vol 60, No 12, p 1377-1388, Dec. 1968. 11 fig, 3 tab, 6 ref.

Descriptors: *Water treatment, *Filtration, *Calcium hydroxide, *Water softening, *Hardness (Water), *Electrolytes, Monitoring, Flow rates, Head loss, Turbidity, *Filters.
Identifiers: *Dual-media filters, *Filter aids.

Water receiving proper pretreatment can be successfully filtered at rates of 5-6 gpm/sq ft, with either a rapid sand filter or a dual-media filter. Pretreatment requirements will vary with the quality of the raw water and should be determined on this basis. When water is properly pretreated, filters may be operated at high rates and changeable rates until they accumulate appreciable suspended matter. When filtration rate increases are necessary, they should be made gradually over a 10-min. period from beginning of the change to the desired rate of flow. The more suspended matter trapped in the filter media, the more impor-

tant it is to avoid a sudden increase in rate. Dual-media filters offer the advantage of less head loss, and a greater capacity for retaining suspended solids. When using dual-media filters, less emphasis need be placed on settleability of suspended matter, but greater emphasis on coagulation. Filter aids can be used to advantage in improving filterability of water, but are no substitute for pretreatment. For good operational control, continuous monitoring of filter effluent turbidity should be practiced. (Bean-AWWA)
W72-04252

FILTER RATE CONTROL WITHOUT RATE CONTROLLERS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
J. L. Cleasby.
Journal of the American Water Works Association, Vol 61, No 4, p 181-185, April 1969. 3 fig, 1 tab, 7 ref.

Descriptors: *Water treatment, *Filters, *Design, *Flow rates, *Flow control, *Filtration, *Head loss.
Identifiers: *Taipei (Taiwan).

Two systems of rate control claimed to have many advantages over the traditional effluent rate control system are described. The two systems are influent flow splitting and variable declining rate. Some plant operating data shows production of better water by the latter control. Both systems eliminate the need for effluent rate controllers, but require arrangements to prevent accidental dewatering of the filter box. They eliminate negative head in the filter. Any filter rate changes occur smoothly; this being the primary reason that better quality may be produced. The variable declining rate system reduces the available head loss needed in the plant and the depth of the filter box needed. Therefore it is the most advantageous of those systems described in this paper. (Bean-AWWA)
W72-04253

DESTABILIZATION OF DILUTE CLAY SUSPENSIONS WITH LABELED POLYMERS,
Florida Univ., Gainesville. Dept. of Chemistry.
A. P. Black, F. B. Birkner, and J. J. Morgan.
Journal of American Water Works Association, Vol 57, No 12, p 1547-1560, December 1965. 12 fig, 4 tab, 29 ref.

Descriptors: Water treatment, *Electrolytes, *Kaolinite, *Clays, *Electrophoresis, Coagulation, Flocculation.

The behavior of polyelectrolytes, as compared with metal coagulants used in conventional water plants, is radically different. Effectiveness of the polyelectrolytes in extremely low concentrations has been demonstrated. With few exceptions, studies on destabilization by polyelectrolytes have used high concentrations of the suspended materials. How cationic and anionic polymers coagulate or flocculate (or both) dilute clay suspensions under controlled solution conditions is shown. The discussion includes, jar tests and microelectrophoresis, polymer adsorption measurements, destabilization, and interactions of the cationic polymer 'PDADMA' and the hydrolyzed polyacrylamide 'HPAM' with kaolinite clay. (Bean-AWWA)
W72-04262

STATUS OF FLUORIDATION IN THE UNITED STATES AND CANADA.
American Water Works Association, New York. Task Group 2620P.

Journal of American Water Works Association, Vol 57, No 11, p 1472-1498, November 1965. 9 tab, 1 ref.

Descriptors: *Water treatment, *Public health, *Fluoridation, Fluoride compounds, United States.
Identifiers: Canada.

Communities in the U.S., Canada and Puerto Rico using controlled or naturally fluoridated water in 1964 are listed, also the populations served, percent of populations in the various states, the type of materials used for fluoridating the supplies, and the authorization by which fluoridation was adopted. Nearly 49 million were served fluoridated water in the United States and 4.1 million in Canada. (Bean-AWWA)
W72-04268

REMOVAL OF ORGANIC CONTAMINANTS BY GRANULAR-CARBON FILTRATION,
Pittsburgh Activated Carbon Co., Pa.
D. G. Hager, and M. E. Flentje.
Journal of American Water Works Association, Vol 57, No 11, p 1440-1450, Nov 1965. 8 fig, 8 tab, 15 ref.

Descriptors: *Water treatment, *Filtration, *Filters, *Activated carbon, *Design, *Taste, *Odor, *Costs, Organic matter, Insecticides, Viruses.

Carbon filtration is an effective process for removing detergents, insecticides, viruses, specific chemical pollutants, and taste and odor pollutants. Granular-carbon beds are more efficient than pulverized carbon used with conventional plant procedures. This advantage compensates for the cost differential of the carbons. Adsorption and removal experiences with the various pollutants are discussed, also filtration-adsorption, chlorine adsorption, and design criteria for granular-carbon beds. Furnace equipment will reactivate granular-carbon at a cost of 2.7 cents per pound. Expenditure for such equipment would be about $50,000. Investment and operating costs for an average 10 mgd plant are reviewed. (Bean-AWWA)
W72-04276

COAGULATION OF ORGANIC COLOR WITH HYDROLYZING COAGULANTS,
Water Research Association Marlow (England).
E. S. Hall, and R. F. Packham.
Journal of the American Water Works Association, Vol 57, No 9, p 1149-1166, September 1965. 16 fig, 4 tab, 20 ref.

Descriptors: Water treatment, *Humic acids, *Fulvic acids, *Color, *Organic matter, *Coagulation, Clays, Hydrogen ion concentration, Zeta potential.
Identifiers: Aluminum sulfate, Ferric chloride.

The coagulation of humic and fulvic acids was studied. The effects of clays on the reactions and results and the relationships with pH and zeta potential are described. In the coagulation of water with aluminum sulfate, organic color in the form of humic and fulvic acids is removed by the precipitation of an insoluble basic humate or fulvate. This is formed by the interaction of a partially hydrolyzed aluminum ion and an ionic group, probably a carboxyl, on the organic molecule. The increasing ionization of a second type of acidic grouping on the organic molecule at pH values above 5 leads to a progressive increase in the coagulant dose required, probably due to the formation of a soluble chelate with aluminum. The distinction between humic and fulvic acids does not have particular significance in relation to the mechanism of coagulation. The actions of iron and aluminum coagulants appear to be essentially similar. (Bean-AWWA)
W72-04305

INTEGRATION OF THE CLARIFICATION PROCESS,
Microfloc Corp., Corvallis, Oreg.
W. R. Conley, Jr.
Journal of the American Water Work Association, Vol 57, No 10, p 1333-1345, October 1965. 9 fig, 1 tab, 8 ref.

Descriptors: Water treatment, *Filters, *Filtration, *Design, Mixing, Flocculation, Sedimentation, Turbidity, Electrolytes, Hydrogen ion concentration, Flow rates, Head loss.
Identifiers: Dual-media filters, Triple-media filters.

The basic requirement for obtaining good coagulation is the addition of the proper amount of the right coagulant in the correct pH zone, with adequate agitation. The process may be monitored in various ways but the most practical way is to filter the water and measure the filtrate turbidity. A high turbidity water will flocculate quickly with minimum agitation, whereas a low turbidity water will require considerable agitation. Present practices provide much greater mixing than required. Use of electrolytes to prevent breakthrough is suggested. The advantages and disadvantages of various filters including dual-media and triple-media filters of sand, coal and garnet are discussed. The optimum filtration rate of 2 gpm/sq ft has generally been abandoned. The optimum for various waters may be from 1 to 10 gpm/sq ft. Continuous monitoring of the filter plant effluent with sensitive turbidimeters is essential for intelligent management of the plant. (Bean-AWWA)
W72-04306

ION-EXCHANGE FOR RECLAMATION OF REUSABLE SUPPLIES,
Stanford Univ., Calif. Dept. of Civil Engineering.
R. Eliassen, B. M. Wyckoff, and C. D. Tonkin.
Journal of the American Water Works Association, Vol 57, No 9, p 1113-1122, September 1965. 6 fig, 3 tab, 4 ref.

Descriptors: *Water treatment, *Water reuse, *Reclamation, *Groundwater, Recharge, *Ion exchange, *Organic matter, *Filtration, Diatomaceous earth, Algae, Treatment facilities.
Identifiers: Filter aids, Diatomite filters.

Pilot plant studies on sewage at Palo Alto, Calif., indicate the most economic treatment to recover reusable water (potability not mentioned) is the ion-exchange process. Inorganic materials, such as nitrogen and phosphorus compounds, and organic materials measured by the chemical oxygen demand, alkyl benzene sulfurate and color tests, can be removed in one operation, providing filtration precedes the ion-exchange process. Water suitable for many purposes, including surface storage, can be produced at a cost competitive with existing supplies in high cost areas. Diatomaceous-earth filtration, followed by anion-exchange, can be accomplished at a cost of about 21 cents per 1,000 gal. Although water reclaimed with ion-exchange will still contain phosphorous and nitrogen compounds, the problem of algae growth in reservoirs will be minimized. A lesser degree of nutrient removal, and consequent lower-cost treatment, would suffice for recharge of ground water. (Bean-AWWA)
W72-04318

IDENTIFICATION AND REMOVAL OF HERBICIDES AND PESTICIDES,
West Virginia Pulp and Paper Co., New York.
E. A. Sigworth.
Journal of the American Water Works Association, Vol 57, No 8, p 1016-1022, August 1965. 2 tab, 5 ref.

Descriptors: Water treatment, *Herbicides, *Pesticides, *Insecticides, *Activated carbon, *Ozone, *Chlorination, *Coagulation, Organic matter, Taste, Odor.
Identifiers: *Potassium permanganate, Aluminum, Iron salts.

A table of data on herbicides and pesticides shows the concentration at which odor is just detectable and the toxicity levels for rats and fish. The various odor types and removal studies are discussed. Coagulation studies with alum and iron salts demonstrated partial but usually insignificant,

removal of a few of the products. DDT was effectively removed. Oxidation studies indicated little merit in chlorination or potassium permanganate treatment. Ozone was somewhat more effective than chlorine dioxide on only a few of the products. It seems evident that oxidation procedures cannot be relied upon to control the gamut of herbicides and insecticides. Adsorption on activated carbon seems to be a logical treatment. All these compounds are relatively complex organic molecules. One method of identifying the amount present is to adsorb them on a bed of carbon and then recover them in concentrated form for analysis. Studies on a relatively few herbicides and insecticides have demonstrated that activated carbon has been successful in reducing the concentration of these toxic compounds. (Bean-AWWA)
W72-04320

PHYSICAL ASPECTS OF FLOCCULATION,
Hazen and Sawyer, Engineers, New York.
H. E. Hudson.
Journal of American Water Works Association, Vol 57, No 7, p 885-892, July 1965. 4 fig, 3 tab, 11 ref.

Descriptors: *Water treatment, *Design, *Flocculation, *Mixing, Coagulation, Sedimentation, Filtration, *Kinetics.

A mathematical relationship describing the kinetics of flocculation was derived. It takes into account flocculation time and intensity, coagulant dose, and volume and solids content of the floc. This relation indicates that the entrapment of floc is influenced by the volume of floc produced rather than by the size or appearance of floc particles. The hypothesis that floc volume is proportional to the coagulant dosage is affirmed. Floc can be made ten times more compact by extended agitation than by limited agitation, without impairing its settling characteristics. Increases in flocculation time and intensity should reduce the work required of filters by reducing the volume of floc to be removed. Experimental work indicates that more than half, and perhaps nearly all, of the suspended particles adhere to floc particles upon colliding during the flocculation process. There is a semi-logarithmic relation between raw-water quality and coagulant dosage required. (Bean-AWWA)
W72-04326

MICROELECTROPHORETIC STUDIES OF COAGULATION WITH ALUMINUM SULFATE,
Dalecarlia Filter Plant, Washington, D.C.
R. L. Williams.
Journal of American Water Works Association, Vol 57, No 6, p 801-810, June 1965. 8 fig, 1 tab, 2 ref.

Descriptors: Water treatment, *Electrophoresis, *Electrolytes, *Coagulation, *Colloids, *Zeta potential, Hydrogen ion concentration, Organic matter.
Identifiers: Aluminum sulfate.

No reliable guide had been available to measure adequately the optimum coagulation dose. The measurement of zeta potential seems to be the answer to this problem. Water with its turbidity fits nicely the definition of a colloidal system. The colloids may be classified as hydrophilic or hydrophobic. The hydrophilic colloids are surrounded by layers of bound water that absorb organic molecules which may cause taste and odor. Therefore their removal is necessary. The hydrophobic colloids are not hydroscopic; they absorb few organic molecules therefore their removal means little. Optimum pH range, mple coagulant and proper mixing were necessary to good coagulation. Also a definite zeta potential range was required, though the range varied with the type and chemical content of various waters. Cationic electrolytes reduced the alum required. (Bean-AWWA)
W72-04379

SLUDGE DISPOSAL BY PRESSING,
Fylde Water Board, Blackpool, (England).
D. Benn, and L. Bridge.
Flyde Water Board, 24 p, 3 fig, 3 ref.

Descriptors: *Design data, Costs, Sludge disposal, Water treatment, Treatment facilities.
Identifiers: *Filter pressing, *Sludge conditioning, *Operational experience, Hodder works (England), Sludge dewatering, Polyelectrolytes.

Experimental, operational, design, and cost data from extensive filter pressing testing of clarification sludge conditioned by a polyelectrolyte are provided. A pilot press was utilized to evaluate the dewatering of sludge from three water utilities. Filter pressing of sludge ffrom the Hodder water facility was successful. A full-size filter press was installed. Filter washwater is dosed with a polyelectrolyte. The mixtures undergoes two stage settling. The final supernatant is discharged to a river and the sludge is withdrawn from the settling basins and stored for pressing. Details of the press design features and operation are provided. Operational experience is discussed including information on sludge thickening, cyclic operation, power, economy, pipework and values, automatic control system, filter cloths, and mechanical handling equipment. Capital, running charge, debt charge, and comparative costs are tabulated. Conclusions based on operating experience are made on the press cycle, degree of system automation, cloth materials, and equipment sizing. (Nardozzi-AWWA)
W72-04402

SLUDGE CONDITIONING BY POLYELECTROLYTES,
Fylde Water Board, Blackpool, (England).
M. A. Hilson.
Fylde Water Board, 14 p, 3 fig, 2 tab, 2 ref.

Descriptors: *Mathematical models, *Sludge disposal, Laboratory tests, Costs, Water treatment, Treatment facilities.
Identifiers: *Sludge conditioning, *Polyelectrolytes, Sludge thickening, Filter pressing, Carman-Kozeny equation, D'Arcy equation, Lime-softening sludge.

The nature of polyelectrolytes is defined and instances where these natural or synthetic polymers made clarification sludges more amenable to dewatering are described. Polyelectrolyte effectiveness can be influenced by seasonal water quality changes. At the Fishmoor plant, sludge is withdrawn from the sedimentation basins and stored. The stored sludge is then transported to a mixing tank where a polyelectrolyte is added. The mixed sludge is gravity fed to a thickener. At the Stocks plant, polyelectrolyte is added to the washwater. The washwater is then settled. Laboratory jar tests to evaluate polymers for sludge thickening efficiency concentrate on the rate of flocculation, floc size, settling rate, and water clarity. Sludge dewatering by filter pressing is predictable by the Carman-Kozeny and D'Arcy equations. The compressibility index and specific sludge resistance primarily affect the dewatering properties. A procedure is presented to evaluate these parameters in the laboratory. Plans are explained to study the conditioning of lime softening sludges. Cost considerations are enumerated. (Nardozzi-AWWA)
W72-04403

CARTER AUTOMATIC BELT-FILTER PRESS.
Carter (Ralph B.) Co., Hackensack, N.J.
For primary bibliographic entry see Field 05D.
W72-04404

THE DISPOSAL OF WASHWATER SLUDGE BY FREEZING,
Fylde Water Board, Blackpool (England).
P. W. Doe, D. Benn, and L. R. Bays.
Journal of the Institution of Water Engineers, Vol. 19, No. 4, p 251-275, June 1965. 11 fig, 9 tab, 4 ref.

Descriptors: *Sludge disposal, *Freezing, Retention, Costs, *Standards, Water treatment, Treatment facilities.
Identifiers: *Washwater sludge, Slow stirring thickener, Stream standards.

Design, layout, and operating data for a sludge treatment sequence are described. Clarification sludge was thickened by slow stirring and retention basin storage before freezing and thawing. Design principles include low capital costs, minimum building space, and future automatic operation of this facility. Plant testing concentrated on improving sludge thickness, freezing efficiency, and thawed sludge supernatant. Operational considerations include settling tank efficiency, sludge build-up, stirring speed variations, sludge extraction, retention tank design, and freezing process cycles. Testing of the freezing equipment generated design improvements that were incorporated into a new plant. Ignition of the thawed sludge followed by alum recovery at the plant concentrated the iron and showed other disadvantages. Frozen sludge lagoon effluent was mixed with sedimentation tank effluent to meet stream standards. Capital depreciation (plant, building), operation, maintenance, and power consumption costs are given. Recommendations are made for future treatment work. (Nardozzi-AWWA)
W72-04405

THE DISPOSAL OF SLUDGE BY THE FREEZING AND THAWING PROCESS,
Fylde Water Board, Blackpool (England).
D. Benn, and P. W. Doe.
Fylde Water Board, February 1969. 19 p, 18 fig, 4 tab, 10 ref.

Descriptors: *Freezing, *Thawing, Sludge disposal, Costs, Ammonia, *Sludge treatment, Treatment facilities, Sludge, Water treatment.
Identifiers: *Aluminum hydroxide sludge, Washwater sludge, Thickening.

The physical and chemical constituents of clarification sludge and an effective sludge treatment process are defined. Clarification sludge is a thick jelly-like colloidal liquid containing organic, inorganic, and coagulant chemical material. The sludge is variable in color, thixotropic, and the organic material can be anaerobically digested. Sludge treatment processes include coagulant recovery, thickening, vacuum filtration, centrifugation, filter pressing, freezing, lagooning, and disposal into sewers or rivers. The steady slow freezing of sludge to 15 deg F creates pure ice crystals. These crystals are necessary for effective liquid-solid separation during thawing. A complete description of the freeze-thaw cycle, using ammonia as a refrigerant, is given. Latent heat is recovered and the thawed mixture flows by gravity. Important design considerations are listed. The process is clean, efficient, automatable, and produces an end product that can be handled. Cost considerations include high capital, operation and maintenance costs, plant depreciation costs, and power costs. Costs are listed for four freezing installations. (Nardozzi-AWWA)
W72-04406

SLUDGE DEWATERING BY FREEZING,
Environmental Protection Agency, Cincinnati, Ohio. Office of Water Programs.
G. S. Logsdon, and E. Edgerley.
Journal of American Water Works Association, Vol. 63, No. 11, p 734-740, November 1971. 13 fig, 4 tab, 29 ref.

Descriptors: *Freezing, Migration, *Sludge treatment, *Water treatment, Dewatering, Sludge, Separation techniques.
Identifiers: Alum sludge, Ferric sludge, Specific resistance, Polymers.

Freezing tests on laboratory prepared hydrous alum and ferric sludges and water treatment plant sludge are described. Sludge-freezing and soil-

freezing literature is reviewed. Conclusions on sludge freezing speed, freeze length, thaw period, and solids content are made. Freezing changes are irreversible. Factors influencing soil-frost heave are enumerated. Data relates freezing speed to sludge dewaterability for test sludges. Settled volume concentrations of frozen-thawed sludge were one-half to one-quarter of unfrozen settled volumes. Macroscopic or microscopic migration of solids particles is required for good water-solids separation and dewatering. Flash freezing is ineffective. Polymers that reduce sludge specific resistance can increase the gross-solids migrations during freezing. Freezing speeds of 60mm/hr appear effective. Polymers can increase the freezing speed. Compressive forces are not necessary for good dewatering of frozen sludge. Spray nozzles should spread thin layers of sludge on frozen sludge beds for efficient natural freezing. (Nardozzi-AWWA)
W72-04407

DEWATERING OF WATER TREATMENT ALUM SLUDGE BY CENTRIFUGATION,
Penwalt Corp., Warminister, Pa.
F. W. Keith.
Presented at 21st Annual Meeting of Pennsylvania Section, American Water Works Association, June 24-26, 1969, Pittsburgh, Pa. 19 p, 5 fig, 4 ref.

Descriptors: *Centrifugation, Dewatering, Regression analysis, *Water treatment, *Sludge treatment, Treatment facilities.
Identifiers: *Basket centrifuge, Alum sludge, Hydrogel.

The utility of an imperforate bowl basket centrifuge to effectively dewater alum sludges is described. Imperforate conveyor centrifuges can produce a 60 percent lime sludge solids cake while selectively classifying magnesium hydroxide. The bowl basket centrifuge can be operated continuously with cyclic cake removal and adaptability to feed solid quality changes. The unit can be automated, requires no coagulant, and creates the least degradation of delicate alum hydrogel floc. Studies in England and the United States indicated 0.5 to 1.5 gpm of sludge is produced per mgd of plant capacity. Regression analyses were performed using sludge concentration, turbidity, centrifugal field residence time, and centrifugal acceleration data. Cake concentration depended on sludge compactibility and centrifugal field residence time. A potential flow diagram to handle sedimentation tank sludge and filter washwater is presented. Recoveries of 90 to 98 percent were achieved at Pickering Creek Water Treatment Plant with this centrifuge. (Nardozzi-AWWA)
W72-04408

OPERATIONAL AND EXPERIMENTAL EXPERIENCE AT DAER WATER TREATMENT WORKS, WITH SPECIAL REFERENCE TO THE USE OF ACTIVATED SILICA AND THE RECOVERY OF ALUM FROM SLUDGE,
Lanark County Water Dept. (Scotland).
J. A. Webster.
Journal of the Institution of Water Engineers, Vol. 20, No. 3, p 167-198, May 1966. 11 fig, 6 tab.

Descriptors: *Sludge treatment, *Sludge disposal, Dewatering, Freezing, Costs treatment facilities, *Water treatment.
Identifiers: *Alum recovery, Activated silica, Slow-stirring thickener, Sulfuric acid, Filter press.

Design and operating criteria developed at the Daer Waterworks to enhance purification sludge settleability and reduce sludge volume for disposal are described. Activated silica is utilized as an aid to aluminum sulfate. An automatic de-sludging system includes a retention mixing tank, chemical handling and dosing facilities, and additional sedimentation tanks. The sludge volume was assessed by laboratory and plant testing. Filter pressing of this sludge was not economical. Experimentation focused on slow-stirring thickening, alum recovery, and freezing of the settled sludge. The recovered alum produced a good floc in the raw water during laboratory tests. A pilot plant was constructed to develop design parameters for the thickening, alum recovery, and freezing operations. Design criteria and operating data are presented for the pilot plant. Refrigeration power costs and chemical savings costs are tabulated. A small sludge cake must be disposed of from the freezing process. (Nardozzi-AWWA)
W72-04409

RECOVERY OF CALCIUM AND MAGNESIUM VALUES FROM LIME-SODA SOFTENING SLUDGES,
Florida Univ., Gainesville.
A. P. Black, Bruce S. Shuey, and Paul J. Fleming.
Presented at 91st Annual Conference, American Water Works Association, Denver, Colorado, June 13-18, 1971. 24 p, 3 fig, 7 tab, 4 ref.

Descriptors: *Water treatment, Centrifugation, Flotation, Costs, Ohio, *Sludge treatment, Filtration, Treatment of facilities, Separation techniques, *Magnesium carbonates.
Identifiers: *Calcining, Carbonation, Dayton (Ohio).

The carbonation of softening sludges containing magnesium hydroxide produces a selective dissolution of the magnesium precipitate to its carbonate form. A tabulation of liquid sludge volumes and calcium carbonate, carbon dioxide, and magnesium hydroxide production is presented for Dayton. Carbon dioxide from lime calcination is utilized to carbonate sludge from settling basins. The mixture is thickened and the calcium carbonate precipitate withdrawn for centrifugation. Lime recovery reduces chemical costs, waste disposal problems, and produces excess lime for sale and carbon dioxide for carbonation. A pilot plant was constructed to produce magnesium carbonate on a batch basis. The process includes carbonation of softening sludge, settling or filtration of calcium carbonate solids, and heating and aeration of the magnesium carbonate solution. The major reactions are listed. The hydrated carbonate precipitate is vacuum filtered, dried, and bagged. Filtrate is recycled to storage tanks for subsequent recovery. Data are provided from the pilot operation. The process is adaptable to waters with high clay turbidities with the addition of a flotation step following recarbonation. Potential magnesium carbonate production capacities and estimated revenues are calculated for 20 cities. (Nardozzi-AWWA)
W72-04410

THE ROLE OF POLYELECTROLYTES IN WATER AND WASTE TREATMENT,
Hercules, Inc., Wilmington, Del. Environmental Services Div.
Ronald D. Lees.
Presented to the Manitoba Department of Health and Social Services, Winnipeg, Manitoba, Canada, March 15, 1971. 19 p, 11 fig, 6 tab.

Descriptors: *Water treatment, Dewatering, Filtration, Sedimentation, Waste water treatment, Sludge treatment.
Identifiers: *Polyelectrolytes, Suspended solids, Bridging action, Thickening, Coagulant aids.

The utility and effectiveness of polyelectrolytes for filtration, sedimentation, and sludge dewatering applications are described. Ionic polymers attract electrically charged colloids, forming bridges between the suspended solids particles. This bridging action enhances settling and dewatering. The most ideal polymers are easy to use, heavily weighted, with excellent pH stability, wide dosage levels, slightly affected by sharp system character changes, and with the proper type and amount of functionality. Polyelectrolytes aid filtration by providing longer filter runs with cleaner filtrates. Polymers improve sedimentation by increasing tank capacities, producing cleaner effluents, and providing thickening and compaction of sludge blankets. Polymers have demonstrated usefulness in dehydrating settled sludge, filter cake, and centrifugation residues. Polymers prove effective as settling aids for the coagulation of phosphates from wastewater. The application of polymers as conditioning agents for flotation and vacuum filtration processes is discussed. On-site in-depth testing is required before the full-scale application of polymers at a facility. (Nardozzi-AWWA)
W72-04411

FILTER PLANT INCLUDES WASTE TREATMENT,
Baker (Michael) Jr., Inc., Rochester, Pa.
Robert L. John.
Water and Sewerage Works, Vol. 118, No. 4, p 96-98, April 1971.

Descriptors: *Waste treatment, Costs, Reclamation, Treatment facilities, *Sludge, Filters.
Identifiers: *Thickening, Offsite disposal, Beaver Falls (Pa), Municipal authority.

Instrumentation, chemical handling equipment, and plant facilities designed to treat the filter wash water and settling basin sludge of a water filtration plant are described. The Clean Streams Law of Pennsylvania requires treatment of purification plant wastes. The filter wash water facilities include a wash water sump and pumps to return the wash water to the raw water supply entering the plant. The wash water provides artificial turbidity which is believed to enhance coagulation and flocculation. Provisions are available to partially dewater this waste in a clarifier-thickener. The alum sludge from the settling basins is discharged to a sump before entering the thickener. Supernatant from the thickener contains less than 100 mg/l suspended solids and is discharged to a stream. A 4 to 5 percent solids sludge is pumped from the thickener to a sump. The alum sludge is pumped into tank trucks for hauling to a pit-lagoon offsite disposal area. Various industrial wastes are disposed there. A tabulation is made of the equipment suppliers and construction costs for the water treatment facility. (Nardozzi-AWWA)
W72-04412

THE DISPOSAL OF SLUDGE FROM WATER TREATMENT PLANTS,
Fylde Water Board, Blackpool (England).
P. W. Doe.
Fylde Water Board, 52 p, 4 tab, 40 ref.

Descriptors: *Sludge disposal, *Dewatering, Settling basins, Lime, Ion exchange, *Sludge treatment, *Water treatment.
Identifiers: *Prevention, Washwater, Rivers Acts (England).

The sludge disposal problem is related to economic and operational considerations and sludge reduction methods to alleviate the potential pollution from these wastes are described. The English Rivers Acts provide monetary penalties for discharging washwater, settling basin and lime sludge, and ion exchange regenerant to watercourses. Sludge prevention principles are enumerated. The choice of the process and raw water source can reduce sludge quantity or concentration. The advantages and disadvantages of lamella sedimentation basins, flotation tanks, slow stirring thickeners, and polyelectrolyte sludge conditioning are discussed. Lime and alumina recovery are referenced to specific plant locations. Design, operation and maintenance, and cost details are listed. The applications of available equipment for dewatering a variety of sludges are presented. Operating, maintenance, and design considerations are mentioned for vacuum filtration, filter pressing, freezing and thawing, lagooning, disposal into sewers or rivers, and centrifugation processes. No universal treatment solution exists. Systems should be flexible and research information coordinated. (Nardozzi-AWWA)
W72-04413

SOME SOLUTIONS TO SLUDGE TREATMENT PROBLEMS AT FISHMOOR TREATMENT PLANT,
Fylde Water Board, Blackpool (England).
A. Brown, and J. Leighton.
Paper presented at Fishmoor Treatment Plant, England, August 10, 1966. 15 p, 6 fig.

Descriptors: *Costs, *Freeze-thaw tests, Design data, Lagoons, Treatment facilities, *Sludge treatment, Dewatering, *Water treatment.
Identifiers: *Filter pressing, *Polyelectrolytes, Thickening, Fishmoor Treatment Plant (England).

Design and cost data are presented for the filter pressing, freezing, polyelectrolyte conditioning, and lagooning of clarification sludge. The sludge dewatering facilities include slow stirring thickeners, sludge retention bunkers, and freezing tanks. Sludge solids concentrations and quantities are listed. Operational difficulties are discussed. The thickener did not function adequately. The thickener was modified and testing was initiated with a Davy Paxman Vacuum Filter, Walmsleys Ltd. Rotoklene Strainer, filter press, and polyelectrolyte sludge conditioning agents. Design, operation, and construction details of a polyelectrolyte conditioning system are presented. Design parameters and operation experience are discussed for the filter press. Lengthy construction considerations are enumerated for the freezing tank design. The freezing cycle time is related to sludge volume, refrigeration area, and freezing efficiency. Capital, operating and maintenance, power, and chemical costs are presented for the major processes employed. (Nardozzi-AWWA)
W72-04414

THE TREATMENT AND DISPOSAL OF WASH-WATER SLUDGE,
Fylde Water Board, Blackpool (England).
P. W. Doe.
Fylde Water Board, March 14, 1958. 27 p, 4 fig, 5 tab, 4 ref.

Descriptors: *Sludge disposal, Dewatering, Heat treatment, Freezing, Sludge treatment, Water treatment.
Identifiers: Thickening, Filter pressing.

An approach to dewatering sludge to a solids concentration suitable for handling and disposal is described. Water clarification sludges vary in composition as well as quantity and concentration. Treatment systems must be flexible. Test results are given for freezing, filter pressing, porous ceramics filtration, and electroosmosis processing of clarification sludge. Experimentation shows preliminary thickening of sedimentation basin sludge to 6% solids should be considered. A thickening tank with a slow stirrer was designed. System parameters investigated include stirring speed, raw sludge concentration, sludge nature, tank shape, mesh used, paddle shape, temperature, and scaling effect. Preliminary test conclusions are enumerated. Washwater sludge can be thickened economically by slow stirring to 5% solids in a relatively short time. Further testing of filter pressing, heat treatment under pressure, and freezing was suggested to handle the prethickened sludge. (Nardozzi-AWWA)
W72-04415

THE PROBLEM OF SLUDGE DISPOSAL AT THE ARNFIELD TREATMENT PLANT (MANCHESTER CORPORATION WATER-WORKS),
Manchester Corp. (England). Waterworks Dept.
For primary bibliographic entry see Field 05D.
W72-04416

WATER PLANT SLUDGE TREATMENT,
Havens and Emerson, Ltd., East Patterson, N.J.
Peter W. Doe.
Presented at Ohio Water Pollution Control Conference, Columbus, Ohio, June 29-July 1, 1971. 25 p, 25 ref.

Descriptors: *Dewatering, Lagoons, Coagulation, Flocculation, Sedimentation, *Sludge treatment, *Waste treatment, Freezing, Filtration, Treatment facilities.
Identifiers: *Filter pressing, Vacuum filtration, AWWA Research Foundation.

Wastes from water treatment facilities vary in composition with the quality of the supply source. Wastes from coagulation, flocculation, sedimentation, and filter backwashing processes are affected by flow and seasonal changes. Sludge generated from reservoir, river, and groundwater supplies is described. The advantages and disadvantages of dewatering by pre-thickening, lagooning, artificial and natural freezing, vacuum-filtration and filter pressing are presented. The AWWA Research Foundation is mentioned as a central clearing-house for new or improved sludge treatment technology. Reference is made to the artificial freezing of alum sludge. Polymer is fed to condition the waste before thickening. Thickened sludge is stored and transported to freezing molds. The thawed sludge is pumped to lagoons for liquid-solid separation. Cost, power, and construction considerations are provided. Plans to filter alum sludge from sedimentation basins and filter backwashing are described. Laboratory and pilot tests were conducted to evaluate design parameters. The presses utilize a precoat, lime, and polymers for conditioning. Two presses can produce 50 tons of cake per 8 hour operation. The cake can be used as landfill. (Nardozzi-AWWA)
W72-04417

USE AND CONTROL OF POLYELECTROLYTE FILTER AIDS IN HIGH RATE FILTERS,
Taulman Co., Atlanta, Ga. Turbitrol High Rate Filter Div.
R. H. Harris.
Presented at 91st Annual Conference, American Water Works Association, June 13-18, 1971. Denver, Colorado. 37 p, 1 tab, 11 fig, 11 ref.

Descriptors: *Turbidity, Monitoring, Head loss, Filters, Treatment facilities, Filtration, *Water treatment, Flocculation.
Identifiers: *Filter aid, Polyelectrolytes, Dual-media filter, Coagulant aid.

The application of filter aids in three Southeastern water treatment plants and a technique for operating and maintaining aid dosage levels are discussed. Filter aids have reduced primary coagulant dosages and produced longer filter runs and high quality filtrate. Head loss build-up and backwashing problems occur with an overdose of aid. Certain polyelectrolyte coagulant aids, activated silica, and ferric sulfate generally strengthen flocs, aiding filtration. A schematic of a filter aid feed system for polyelectrolytes is presented. A turbidity monitoring system utilizing a 90 degree scatter nephelometer type turbidimeter is detailed. Optimum filter performance is obtained in dual-media filters, with a coarse anthracite top and sand bottom, when 90 to 95 percent of the turbidity is removed in the anthracite portion and anthracite-sand interface turbidities are cyclically monitored. Data on raw water character, treatment conditions, and test results are enumerated for the three treatment facilities using this system. (Nardozzi-AWWA)
W72-04418

USE OF BIMETALLIC GLASSY PHOSPHATES FOR CORROSION CONTROL,
Calgon Corp., Pittsburgh, Pa.
J. P. Kleber.
Journal of American Water Works Association, Vol 57, No 6, p 783-790, June 1965. 4 fig, 1 tab, 10 ref.

Descriptors: *Water treatment, *Corrosion, *Phosphates, *Sodium compounds.
Identifiers: *Red water, *Tuberculation, *Zinc compounds.

The effectiveness of bimetallic glassy phosphates (sodium-zinc glassy phosphate) is compared to that of sodium polyphosphate glass in control of tuberculation, corrosion, and red water in distribution systems. Sodium-zinc glassy phosphate containing 9 percent zinc was developed in the 1950's. It's very slow solubility was a deterrent to use. A more soluble form, containing 12 percent zinc, soluble to 1 lb/gal, and available either as glassy platelets or granulated, has been marketed recently. The sodium-zinc glassy phosphates are subject to the same restrictions in use as the sodium polyphosphates. Neither is effective at pH values above 8, though the bimetallic form is somewhat more effective. Maximum effectiveness on iron and steel is at pH 6.0-7.5. Both require at least 1 ppm of calcium in the water for each 4 to 5 ppm phosphate, and each requires for best results, at least 1 gpg hardness. Neither is particularly effective as an inhibitor of copper corrosion at pH values below 6.5-6.7. (Bean-AWWA)
W72-04428

BASIC EXPERIMENT ON THE REMOVAL OF RADIOACTIVITY FROM WATER,
Niigata Univ., Nagaoka (Japan).
K. Mori.
Suido Kyokai Zasshi, No. 433, p 26-34, October 1970.

Descriptors: *Water pollution, *Contamination (Water), *Pollution (Stream), *Water pollution sources, *Pollution abatement, *Water pollution treatment, Radioactive fallout, Washout (Atmospheric), Strontium radioisotopes, Cesium, Radioisotopes, Coagulation, Flocculation, Filters.
Identifiers: Drinking water, Twon water, Fission products, Decontamination.

Experiments were made on the removal of radioactivity from water. The purpose was to remove radioactive fission products (FP's) in town water due to fallout in precipitation. Test water was prepared by adding fission products, 137 (Cs), and 90 (Sr) to either river water or town water. Flocks were formed using coagulants. To enhance decontamination, the supernatant was filtered. The coagulant is Al2 (SO4)3.18H2O; the auxiliary coagulant is Ca (OH)2 or Na2CO3). Adhesion and precipitating agents used in some cases are active carbon, and CaCl2 + Na2HPO4.12H2O respectively. The decontamination was dependent largely on the isotope muddiness, and pH. As a whole, the FP was easier to remove than Sr or Cs. (Houser-ORNL)
W72-04456

PUBLIC HEALTH IMPLICATIONS OF RADIOACTIVE WASTE RELEASES.
World Health Organization, Geneva (Switzerland).
For primary bibliographic entry see Field 05C.
W72-04483

CONSUMER ASSESSMENT OF MINERAL TASTE IN DOMESTIC WATER,
California Univ., Berkeley. School of Public Health.
W. H. Bruvold, H. J. Ongerth, and R. C. Dillehay.
Journal of the American Water Works Association, Vol. 61, No 11, p 575-580, November 1969. 3 fig, 8 tab, 10 ref.

Descriptors: *Water treatment, *Water quality, *Public health, *Taste, *Mineral water, *Standards, *California.

Californians rated their own mineralized water supplies as to taste, from which standards limiting mineral content were recommended. By means of an interview schedule of 12 questions as to attitudes and taste scale ratings, consumer surveys were performed for 29 water systems. Systems were selected to eliminate those that might have taste or odor produced by substances other than the normal dissolved minerals being studied (calci-

um, magnesium, sodium, bicarbonate-carbonate, chloride, nitrate, and sulfate). No high-carbonate or high-chloride waters were included; for the waters studied all major ionic constituents correlated highly with the total dissolved solids (TDS). An inverse linear relation was found between scale scores and the TDS. The average results of five means of evaluating taste against TDS (ppm) were excellent-equal or less than 319, good-320-658, fair-659-996, poor-997-1332, and unacceptable-equal or greater than 1333. (Bean-AWWA)
W72-04494

ORGANIC MATTER AND FINISHED WATER QUALITY,
East Bay Municipal Utility District, Oakland, Calif.
J. J. Connors, and R. B. Baker.
Journal of the American Water Works Association, Vol 61, No 3, p 107-113, March 1969. 6 fig, 2 tab, 10 ref.

Descriptors: *Water treatment, Water quality, *Organic matter, Algae, Copper sulfate, *Chemical oxygen demand.
Identifiers: Total organic carbon.

Water quality deterioration can occur because of organic matter after water has left the treatment plant. Significant differences in the amount of organic matter and algal biomass can occur but not be indicated by chemical analysis. Copper sulfate may not control total organic matter. In some reservoirs the total organic load as measured by the Chemical oxygen demand (COD) is established by the character of the runoff. Organic removals by filtration are slight compared with those by coagulation and sedimentation. The TOC apparatus for measuring 'total organic carbon' will be useful for continued studies. The COD test, whatever it measures, can be made to yield good precision with potable waters. (Bean-AWWA)
W72-04495

TREATMENT OF HIGH NITRATE WATERS,
Federal Water Pollution Control Administration, Fresno, Calif. San Joaquin Project.
P. P. St. Amant, and P. L. McCarty.
Journal of the American Water Works Association, Vol 61, No 12, p 659-662, December 1969. 2 fig, 3 tab, 5 ref.

Descriptors: *Water treatment, *Water quality, *Nitrates, *Nitrites, *Denitrification, *Biological treatment, Filtration, Taste, Odor.
Identifiers: *Methanol.

Biological denitrification in filter beds had the stability and efficiency of operation necessary for treatment of a drinking water supply. During biological denitrification, nitrates and nitrites were reduced to nitrogen gas; 90 to 97 percent removal was accomplished with 1 hr detention, the influent contained 15 to 22 mg/l NO3. To promote denitrification, an organic electron donor must be added; methanol is satisfactory and inexpensive for this purpose. Careful control of the feeding of methanol is necessary to prevent problems resulting from either underdosage or overdosage. Additional research is needed to determine the hydraulic characteristics of large-scale filters and to evaluate the palatability of denitrified water. (Bean-AWWA)
W72-04496

NONIONIC POLYMER FLOCCULATION OF DILUTE CLAY SUSPENSION,
Maryland Univ., College Park. Dept. of Civil Engineering.
F. B. Birkner, and J. K. Edzwald.
Journal of the American Water Works Association, Vol 61, No 12, p 645-651, December 1969. 6 fig, 5 tab, 21 ref.

Descriptors: *Water treatment, *Coagulation, *Flocculation, *Clays, *Electrolytes, *Kaolinite, Cationics absorption, Anionic absorption, Hydrogen-ion absorption.
Identifiers: *Nonionic absorption, Polymers.

The chemical and physical mechanisms involved in the destabilization of kalinite clay suspensions with a non-ionic polymer, polyethylene oxide were studied. Effects of various solution parameters, such as pH, cation valence, and cation concentration, on the polymer destabilization reaction were determined. The clay suspensions contained 60.1 ppm clay, and were buffered to pH 8.3 with sodium bicarbonate. Coagulants were NaCl and CaCl2. Adsorption data are presented and discussed. Solution pH and the type of counterion which predominates in the solution phase have a significant effect on the adsorption of polyethylene oxide onto kaolinite clay surfaces. Under conditions of constant ionic strength at pH 8.3, twice as much polymer adsorption occurs when sodium ions are the predominant cation species in the solution phase than when calcium ions predominate. Adsorption is significantly reduced by raising the solution pH from 8.3 to 12 or by lowering it to 2.5. (Bean-AWWA)
W72-04497

CAPPING SAND FILTERS,
Kenosha Water Dept., Wis.
O. F. Nelson.
Journal of the American Water Works Association, Vol 61, No 10, p 539-540, October 1969. 1 tab.

Descriptors: *Water treatment, *Design, *Filters, *Sands, *Flow rates, Treatment facilities.
Identifiers: *Anthracite, *Dual-media filters.

Filters with four to six inches of 0.9 mm anthrafilt capping over 0.5 mm sand were operated over a two-year period at Kenosha, Wisconsin. Filters made of the proper size and depth of anthracite and sand together are superior to filters made only of sand. The more adverse the applied water conditions, relative to algae and floc, the more dramatic were the results obtained with the capped filter. Good water conditions gave 2 to 1, the worst water conditions gave 10 to 1 improvement. The capped filter could be operated at 3 gpm/sq ft. with quality of effluent equal to that of sand filters. Short filter runs were eliminated and a substantial saving in washwater was obtained with use of capped filters. (Bean-AWWA)
W72-04498

TASTE QUALITY OF MINERALIZED WATER,
California Univ., Berkeley. School of Public Health.
W. H. Bruvold, and H. J. Ongerth.
Journal of the American Water Works Association, Vol 61, No 4, p 170-174, April 1969. 2 fig, 7 tab, 10 ref.

Descriptors: *Water treatment, *Water quality, *Taste, *Mineral water, *Dissolved solids, *Psychological aspects.

Psychometric scaling methods were used to show an inverse linear relationship between general taste quality and the total mineral content of waters. The reliability of this inverse relationship was attested by the similarity of four different regression equations. Water could be graded on the basis of the linear total dissolved solids (TDS) functions, which accounted for the major portion of the explainable variance in rating scale scores. It would appear that the limit for mineral content should be the highest TDS value resulting in no dissatisfaction with the mineral taste in the water. However, dissatisfaction with the taste of a water will be found by some percentage of those testing it, therefore, a value judgement is needed to decide what degree of dissatisfaction can be accepted. Perhaps the potability should be rated on the basis of the percentage of testers who are dissatisfied with the water's taste. Potability grades are suggested, with percentage cut-off points of 15, 25, 35, 45 and 100 percent of testers dissatisfied. These conformed respectively to approximately 300, 600, 900, 1100 and over 1100 TDS. Corresponding ratings are suggested as excellent, good, fair, poor and unacceptable. Reliable assessment of the general taste quality of mineralized water can be obtained by methods of psychometric scaling. (Bean-AWWA)
W72-04499

RECARBONATION AND LIQUID CARBON DIOXIDE,
Black and Veatch, Kansas City, Mo.
P. D. Haney, and C. L. Hamann.
Journal of the American Water Works Association, Vol 61, No 10, p 512-521, October 1969. 6 fig, 8 tab, 49 ref.

Descriptors: *Water treatment, *Water softening, *Carbon dioxide, *Design, Automation, Costs, Prices, Absorption, *Efficiencies, Flexibility, Hydrogen ion concentration.

Many plants include recarbonation as part of their water softening procedure. Recarbonation is defined as the process of adding carbon dioxide to lime-softened, clarified water for purpose of reducing the pH and promoting chemical stability. Modern generators of czrbon dioxide have many advantages over earlier systems. However, they suffer from lack of flexibility, excessive maintenance, the necessity for careful control and operator attention, and difficulties of adsorption of the carbon dioxide into the water, since the gas contains, at best, only 10 per cent CO2. The range of efficiency is suggested as being only 40 to 60 percent. The steady decrease in purchase cost of liquid CO2 has caused increasing attention to its use, replacing on-site generation. Its advantages include high purity, high efficiency, flexibility, ease of control and adaptation to automation. Its principal disadvantage, in some areas, is high cost. Consideration of the following items should lead to a correct decision as to recarbonation facilities to be installed: annual usage, storage capacity required, cost of storage and feed facilities, delivered price and future price outlook, value of 'ease of control' aspects of liquid use, and present CO2 adsorption efficiency vs that with the liquid use. (Bean-AWWA)
W72-04500

VIRUSES IN WATER.
American Water Works Association, New York. Committee on Viruses in Water.

Journal of the American Water Works Association, Vol 61, No 10, p 491-494, October 1969. 13 ref.

Descriptors: *Water treatment, *Water quality, *Viruses, *Disease, *Epidemics, *Infections, Turbidity, Chlorination, Time reactions.

Waterborne infection and the epidemics in which drinking water was suspected as the cause are discussed, also the epidemiological evidence for and against the probability that drinking water was the cause. In some cases evidence is insufficient to uphold the suspicion, in others the water was not adequately treated, in others polluted water became mixed with treated water. Production of very low turbidity water (0.1 to 1 jtu) with a minimum of 30 min contact with 1 ppm free chlorine residual is supported. There does not appear to be cause for panic or overreaction to the problem of viruses in water. Under certain conditions, infectious hepatitis can be transmitted by treated water, but the evidence indicates that in such cases the treatment was inadequate. The evidence for the transmission of other enteric viruses by treated water is, for the most part, speculative, with the possible exception of viral gastroenteritis and diarrhea, and nothing much is known about these viruses. (Bean-AWWA)
W72-04501

MULTILAYER FILTRATION,
London Univ., (England).
S. S. Mohanka.
Journal of the American Water Works Association, Vol 61, No 10, p 504-511, October 1969. 12 fig, 3 tab, 6 ref.

Descriptors: *Water treatment, *Filtration, *Filters, *Design, Head loss, Flow rates, Sands, Treatment facilities.
Identifiers: *Multilayer Filters, Polystyrene, Anthracite, Garnet sand, Magnetite, Backwashing.

Head losses and backwashing characteristics were evaluated in filtration by multilayer beds utilizing polystyrene, anthracite, crushed flint sand, quarry sand, garnet sand, and magnetite. The multilayer filter permits deeper penetration of flocs, and therefore could be utilized more efficiently than the sand filter. The main problem is the requirement of more backwash water and sufficient room for expansion of the top layer. The polystyrene is lightweight and expand's more than other materials, also it is hydrophobic and collect's air bubbles which cause grains to float. Programmed backwashing cycles which would progressively expand and fluidize the bed should be used to insure proper cleaning of the multilayer filter. Garnet and magnetite exhibited removal characteristics similar to crushed flint sand. For the same filtrate concentration during a given run time, the ratio of head loss in sand filter to that of multilayer filter was 2.5 at 2, 2 at 4, 1.75 at 6, and 1.6 at 8gpm/sq ft. The use of polystyrene as a top layer was not as efficient as expected. Therefore, careful consideration should be given to selection of the top layer of a multilayer filter bed. (Bean-AWWA)
W72-04502

POTASSIUM PERMANGANATE REMOVAL OF TASTES AND ODORS FROM PAPER MILL WASTES,
Anne Arundel County Utility Operations Bureau, Glen Burnie, Md.
J. J. Boland, and W. E. DeArment.
Journal of American Water Works Association, Vol 57, No 11, p 1451-1455, November 1965.

Descriptors: *Water treatment, *Lignins, *Taste, *Odor, *Activated carbon, Hydrogen ion concentration, *Water pollution treatment.
Identifiers: *Tannins, *Potassium permanganate.

Water the color of strong tea, with white foam and a sickly sweet, woody taste and odor sometimes compared to pine oil was produced by wastes of a paper mill. This effluent contained tannins and lignins on the order of 0.7 percent, when measured as tannic acid. The water was used to supply consumers at Erie, Pa. Concentration above 0.5 ppm in finished water is readily detectable by most people as an objectionable woody taste. Alum dosage of 86 ppm and carbon of 30 ppm reduced concentrations of 2.7 ppm only to 1.6 ppm. At pH of 8.3, potassium permanganate dosages of 1.5 to 2 ppm reduced tannin-lignin concentrations from 0.8-1.6 ppm in the raw water to 0.1-0.5 ppm in the finished water. There was no exceptional taste, odor, or color to the latter. (Bean-AWWA)
W72-04503

CARBON BED DESIGN CRITERIA STUDY AT NITRO, W. VA,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
K. A. Dostal, R. C. Pierson, D. G. Hager, and G. G. Robeck.
Journal of American Water Works Association, Vol 57, No 5, p 663-674, May 1965. 8 fig, 4 tab, 4 ref.

Descriptors: *Water treatment, *Water quality, *Design, *Activated carbon, *Filters, *Filtration, *Standards, *Organic matter, Aeration, Chlorination, Odor, Treatment facilities, Chemical oxygen demand.
Identifiers: Carbon-chloroform extract.

A series of small scale experiments and a full-scale test were made to obtain data on granular-carbon consumption in removal of organic materials from Kanawha River water at Nitro, W. Va. Treatments included double aeration, chlorination, coagulation and sand filtration, followed by granular-carbon filtration. The granular-carbon reduced both odorous and nonodorous organic materials sufficiently to meet recommended drinking water standards. The standard size granular-activated carbon (8 x 30 mesh) in beds produced odor-free water for as long as 26 days (threshold odor number (TON) varied from 300 to 1,300). A finer carbon (20 x 50 mesh) produced odor-free water for about twice as long. A linear relationship was found between contact time and carbon performance. When the TON was reduced to less than 3, the COD was reduced to less than 7 ppm and the Carbon-chloroform extract was generally reduced to less than 200 ppb. (Bean-AWWA)
W72-04504

APPROACHES TO A FILTERABILITY INDEX FOR GRANULAR FILTERS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
J. L. Cleasby.
Journal of the American Water Works Association, Vol 61, No 8, p 372-381, August 1969. 15 fig, 3 tab, 19 ref.

Descriptors: *Water treatment, *Filtration, *Head loss, *Flow rates, *Standards.
Identifiers: *Filterability index.

Granular filtration is a very complex process. Different suspensions yield effluent quality and head loss curves of several shapes. Some yield linear head loss development with time, while others are exponential (curved upwards). The probability of developing a rational filtration equation to fit all types of suspensions is rather remote. Much of the information to predict filter performance can be obtained by filtration of water through two shallow depth filters (3- and 6-in depths), at constant rate, with observation of head loss and effluent quality. (For more detailed research, filters of three or more depths should be operated.) A method for calculation of a numerical index of filtration is proposed. The calculations are simple to perform. It is recommended that a device similar to the above be used with a standard media, such as 20-25 mesh Ottawa sand, with a standard operating procedure and the filterability index be developed for a standard test. Filtration-time tests made with a membrane or similar filter have some value in predicting filter cake resistance in diatomic filtration. However, such tests can give totally misleading results if applied to granular filters which produce removal and head loss in depth. (Bean-AWWA)
W72-04505

SCHISTOSOMIASIS CONTROL IN WATER SUPPLY SOURCES,
National Inst. of Allergy and Infectious Diseases, Bethesda, Md.
J. A. Scott.
Journal of the American Water Works Association, Vol 61, No 7, p 352-354, July 1969. 14 ref.

Descriptors: Water treatment, Water quality, *Public health, *Diseases, Snails.
Identifiers: *Schistosomiasis.

Schistosomiasis, a disease afflicting perhaps 200,000,000 people chiefly in tropical climes, may spread as more water storage and irrigation projects are begun. Control of the host snails causing spread of this disease should be a team project of biologists and engineers. Research in fundamental aspects is constantly producing results that should be tested for practical applicability to control projects. How water impoundments can be managed to keep them free of snails is an important subject for field research. The design of channels for distribution of water and the design of irrigation systems are engineering problems of great importance in many countries. Methods for applying molluskicides under various conditions are in need of further study. In short, there are many areas in which engineers with imagination can make outstanding contributions to the control of schistosomiasis and to the prevention of its spread into new districts. (Bean-AWWA)
W72-04507

DIATOMITE FILTRATION SYSTEM OF LOMPOC, CALIF.,
Koebig and Koebig, Inc., Los Angeles, Calif.
C. H. Lawrance.
Journal of the American Water Works Association, Vol 61, No 7, p 327-332, July 1969. 1 fig, 2 tab, 6 ref.

Descriptors: *Water treatment, *Filtration, *Filters, *Diatomaceous earth, *Water softening, *Iron, *Manganese, Suspended load, Sodium compounds, Mixing, Flocculation, Sedimentation, California.
Identifiers: *Suspended solids, Sludge return, Recarbonation, *Lompoc (Calif).

Functions of the Lompoc Water Treatment are the reduction of excessive total dissolved solids of the local well supply and, coincidentally, the provision of economical centralized softening, removal of iron and manganese, and production of a sparkling, clear, palatable effluent. The process selected for solids reduction and softening was cold lime-soda. Chemical application facilities were provided for sodium aluminate, pebble lime, and soda ash, also sodium hexametaphosphate. Facilities were provided for flash mixing, flocculation, clarification, sludge recirculation and recarbonation utilizing natural gas as fuel. Following study the filtration facilities were changed from rapid sand to diatomite type. Operating data are presented for the months of Feb. and August in the years 1964, 1965, 1966, 1967 and 1968. The plant was designed with the philosophy of providing the greatest utility and flexibility at the least possible cost commensurate with the projected water demands for the community, the funds available, and the desire for minimization of future capital outlays to meet increasing water demands by the expanding population. The diatomite filtration system has performed well as a vital component of a major lime-soda softening plant, beyond the expectations of the manufacturer and the engineers. (Bean-AWWA)
W72-04508

EFFECTS OF POTASSIUM PERMANGANATE ON PURE ORGANIC COMPOUNDS,
Miami Univ., Corral Gables, Fla. Dept. of Civil Engineering.
R. G. Spicher, and R. T. Skrinde.
Journal of the American Water Works Association, Vol 57, No 4, p 472-484, April 1965. 7 fig, 6 tab, 11 ref.

Descriptors: *Water treatment, *Oxidation, Amino acids, Alcohols, Phenols.
Identifiers: *Potassium permanganate, Ketones, Aniline, Carboxylic acid.

The aldehydes, amines, aromatic alcohols, and keto acids were readily oxidized by permanganate, whereas the carboxylic acids, ketones, aliphatic alcohols, hydroxy acids, amino acids, and some esters were not readily oxidized. The double bond of alkenes was readily oxidized. Aldehydes were oxidized to acids. Benzyl alcohol and benzaldehyde were oxidized to benzoic acid. The benzene ring of phenol and aniline was apparently broken by oxidation with permanganate. (Bean-AWWA)
W72-04509

EVOLUTION OF WATER QUALITY GOALS,
Philadelphia Water Dept., Pa.
E. L. Bean.

Journal of the American Water Works Association, Vol 61, No 7, p 317-320, July 1969. 11 ref.

Descriptors: *Water treatment, *Water quality, *Standards, *Research, Taste, Odor, Color, Turbidity, Corrosion, Organic matter, Insecticides, Zeta potential, Viruses, Toxicity, Instrumentation, Nitrates.
Identifiers: Methemoglobinemia, Schistosomiasis.

The need for Goals and the status of USPHS Standards as minimum levels of quality are discussed. The development of the 'Water Quality Goals for Potable Water' and their adoption by the American Water Works Association as targets for the industry in production of quality water are described. Also, the practicality of the Goals. Higher quality would improve public relations. Each utility management must take its own determination of what is justified in its system and circumstances. A survey was being initiated to determine the actual status of field control being exercised for the purpose of producing and delivering quality potable water. Research needs were briefly discussed with respect to corrosivity, organic constituents, insecticides, zeta and streaming potentials, concentration of minerals, schistosmiasis, methemoglobinemia and nitrates, viruses, detection of toxicity, and instrumentation. As research yields solutions, the industry will progress toward quality water. In the meantime, consumer characteristics - those qualities of which the consumer is directly and perhaps acutely aware, such as taste, odor, color, turbidity, staining, and corrosion - are the factors which now need attention and continuing effort. (Bean-AWWA)
W72-04510

STATUS OF FLUORIDATION IN THE UNITED STATES AND CANADA, 1963.
American Water Works Association, New York. Task Group 2620P.

Journal of American Water Works Association, Vol 57, No 1, p 76-84, January 1965. 2 fig, 9 tab.

Descriptors: *Water treatment, *Fluoridation, *Fluorides, *Water quality, *Public health.

In the U.S. 291 communities and military establishments were added to the list of those serving fluoridated water in 1963. These serve more than 2.6 million people. In Canada 30 communities were added, serving 800,000 people. This was a gain of 91 percent in the population served in Canada and reflect the inclusion of Toronto. More than 46.6 million persons in the U.S. and 3.8 million in Canada were served fluoridated water in 1963, with another 7.5 million using naturally fluoridated water containing at least 0.7 ppm of fluoride, thus a total of over 58 million people in the U.S. and Canada drank fluoridated water. (Bean-AWWA)
W72-04511

EFFECT OF PARTICLE SIZE ON TURBIDITY REMOVAL,
Florida Univ., Gainesville.
A. P. Black, and M. R. Vilaret.

Journal of the American Water Works Association, Vol 61, No 4, p 209-214, April 1969. 6 fig, 2 tab, 14 ref.

Descriptors: *Water treatment, *Turbidity, *Particle size, *Electrolytes, *Coagulation, *Flocculation, *Hydrolysis, Aluminum.
Identifiers: Suspended particles, Surface area, Polymers.

Particle size has a definite effect on the kinetics of the destabilization process, making it faster, the smaller the size. The smaller size particles always produced the larger masses of floc. In flocculation with a cationic polymer, the dosages that produce optimum turbidity removal increase directly with the surface area of the system, which in turn is inversely proportional to the size of the suspended particles. In the case of a nonionic polymer used in conjunction with a metal coagulant, particle size qualitatively affects the polymer dosages for optimum destabilization, the smaller particles requiring higher dosages. In coagulation with a nonhydrolyzing metal coagulant no optimum dosages are observed, and particle size has no marked effect on required coagulant dosages. With a coagulant such as alum, which is polymerized through hydrolysis at certain pH values, particle size has only a qualitative effect on the required dosages. This relationship is not as well defined as in the case of high polymers. (Bean-AWWA)
W72-04512

REMOVAL OF SOLUBLE IRON BY FILTRATION,
Johns-Manville Research Center, Manville, N.J.
G. R. Bell.

Journal of the American Water Works Association, Vol 57, No 4, p 458-471, April 1965. 8 fig, 5 tab, 8 ref.

Descriptors: *Water treatment, *Diatomaceous earth, *Iron, *Manganese, Lime, Sodium compounds, Aeration, Hydrogen ion concentration, Massachusetts, Filters.
Identifiers: Potassium permanganate, Filter aids, Diatomite filters.

In pilot-plant studies of sand and diatomite filtration, lime or soda ash provided partial precipitation of iron in filterable form over limited pH range. A soft ground water containing 8-9 mg/l Fe was successfully treated with lime through the pH range of 7.8 - 8.6 at Amesbury, Mass. Residual iron was less than 0.1 ppm. Limited processing time was desirable in order to prevent formation of an unfilterable floc. An optimum of 10 min. with mild agitation sufficient to keep the filter aid in suspension was effective. Aeration is desirable both for CO2 removal and introduction of O2. Precipitated iron is more impermeable than the MgO-Fe complex, and higher body feeds are required. Where manganese is also present, lime or soda ash can be used in conjunction with potassium permanganate to effect removal of both Fe and Mn in a single filtration in which MgO is less effective. (Bean-AWWA)
W72-04548

ELECTROPHORETIC STUDIES OF COAGULATION AND FLOCCULATION OF RIVER SEDIMENT SUSPENSIONS WITH ALUMINUM SULFATE,
Florida Univ., Gainesville. Dept. of Chemistry.
A. P. Black, and C. Chen.

Journal of the American Water Works Association, Vol 57, No 3, p 354-362, March 1965. 6 fig, 2 tab, 17 ref.

Descriptors: *Water treatment, *Electrophoresis, *Zeta potential, *Coagulation, *Flocculation, *Hydrogen ion concentration, Filtration, Clays.
Identifiers: Aluminum sulfate.

Natural-clay sediments exhibit behavior rather similar to that of pure clay suspensions. This similarity can be explained by postulating that both coagulation and flocculation are strongly controlled by the properties of the coagulants. Both zeta potential effects and physical adsorption phenomena are probably involved in the coagulation of clay suspensions, when hydrolyzing aluminum sulfate is used as the coagulant. Throughout most of the pH range, the electrophoretic-mobility data can be related to the residual turbidity. At pH values higher than 8, however, the mobility data can hardly be used to explain the variation of residual turbidity. Although the electrophoresis technique is recognized as a very useful tool for investigating the mechanism of coagulation and flocculation, the application of this technique to predict the optimum coagulant dosage in water treatment has not been fully demonstrated. The conventional 'jar test' technique remains the preferred method for determining the optimum coagulant dosage. (Bean-AWWA)
W72-04564

ELECTROPHORETIC AND TASTE AND ODOR MEASUREMENTS IN PLANT CONTROL,
Franklin Inst., Philadelphia, Pa.
R. A. Baker, S. J. Campbell, and F. R. Anspach.

Journal of American Water Works Association, Vol 57, No 3, p 363-374, March 1965. 4 fig, 4 tab, 16 ref.

Descriptors: *Water treatment, *Water quality, *Electrophoresis, *Coagulation, *Filtration, *Taste, *Odor, Hydrogen ion concentration, Zeta potential.

Coagulation to the isoelectric point does not in itself assure zero odor. No physical, chemical or biologic parameter by itself serves as a substitute for sensory control using persons. Electrophoretic monitoring of chemical coagulation and odor profile measurement result in maximum economy in the form of lower chemical costs and satisfactory water quality. Electrophoretic monitoring is a potentially useful tool for plant control. The method is rapid, provides an ideal supplement or possible replacement for jar tests, and is amenable to use by the small water plant. (Bean-AWWA)
W72-04565

QUALITY IMPROVEMENT FOR LOMPOC, CALIF.,
Loebig and Loebig, Inc., Los Angeles, Calif.
C. H. Lawrence.

Journal of American Water Works Association, Vol 57, No 5, p 607-624, May 1965. 6 fig, 9 tab, 8 ref.

Descriptors: *Water treatment, *Water quality, *Hardness (Water), *Water softening, *Distribution systems, *Corrosion, *Diatomaceous earth, *Filtration, Sludge, *Ion exchange, Flocculation, Sedimentation, Lime, Soda compounds, Treatment facilities, California.
Identifiers: *Lompoc (Calif), *Recarbonation, Filter aids, Diatomite filters.

The Lompoc Water Supply had a total hardness of about 750 ppm and a total residue of 1,350 ppm. Distribution system conditions were far from satisfactory and consumers far less than satisfied. Lompoc is the source of most diatomite. Studies showed use of diatomite filters would be little more costly than sand filters, so a new 7 mgd plant was built based on diatomite filtration with lime-soda softening capable of softening to 100 ppm hardness at the designed rate. Plans for lime-ion exchange softening were dropped because a brine waste line to the Pacific Ocean would have been required. Effluent hardness has averaged 150 ppm. Calcium carbonate scaling of plumbing and fixtures has been eliminated, as have red water stains. Plumbing maintenance costs have been lowered. Washing costs and fabric wear in laundering have been reduced, and laundries and car wash establishments have benefited economically. The plant effluent is adjusted to maintain a slightly positive saturation index for protection against distribution system corrosion. (Bean-AWWA)
W72-04566

TREATMENT WITH OZONE,
Jennings (A. G.), Sligo (Ireland).
D. C. O'Donovan.

Journal of American Water Works Association, Vol 57, No 9, p 1167-1194, September 1965. 16 fig, 3 tab, 23 ref.

Descriptors: *Water treatment, *Water quality, *Ozone, *Microstraining, *Color, *Taste, *Odor, *Disinfection, Organic matter, Turbidity.
Identifiers: Ireland.

THE MICROSTRAINING-OZONATION TREATMENT OF WATER WAS STUDIED. The ozonation technique is described, including conditioning of air and production of ozone, its introduction into water and determination of ozone

residuals in water and air. Installations are producing satisfactory results by utilizing microstraining to remove algae and ozonation to reduce color, often the total results desired in their water supplies. Ozonation appears to have a definite place in the future of water treatment in Ireland. Ozone is one of the strongest sterilizers known and is a powerful color-reducing agent. Where its color-reducing potential can be exploited, substantial economies will often be realized by the introduction of ozonation. (Bean-AWWA)
W72-04567

CATION-EXCHANGE CAPACITY AND PH IN THE COAGULATION PROCESS,
Engineering-Science Inc., Arcadia, Calif.
W. Kim, H. E. Ludwig, and W. D. Bishop.
Journal of American Water Works Association, Vol 57, No 3, p 327-348, March 1965. 15 fig, 3 tab, 28 ref.

Descriptors: *Water treatment, *Ion-exchange, *Hydrogen ion concentration, *Coagulation, Filtration, *Clays, Bentonite, Kaolinite.

The importance of the cation-exchange capacity (CEC) of suspended clays in the coagulation process was first shown by Langelier and Ludwig. Methods of determining the CEC are discussed, and compared on three clays. Coagulation of bentonite and kaolinite clays was studied, with alum coagulant and variable alkalinities and pH, with clay suspensions under 100 ppm. Kaolinite suspensions can best be treated at the isoelectric point. Addition of small amounts of bentonite can aid coagulation when the pH is lowered below the isoelectric. When suspensions of bentonite are treated, the addition of kaolinite may save coagulant. Kaolinite suspensions include quartz, kaolinite, mica, and illite, the median size is about 1 micron. Bentonite suspension particle size is less than 0.5 micron. The predominant clay type may be determined, and the proportion of bentonite to kaolinite in a suspension may be approximated from the CEC to turbidity ratio. The coagulation step should be evaluated in terms of filterabiltiy as well as reduction of turbidity prior to filtration. (Bean-AWWA)
W72-04568

EXPERIENCES WITH MULTIPLE-BED FILTERS,
Philadelphia Surburban Water Co., Bryn Mawr, Pa.
K. E. Shull.
Journal of American Water Works Association, Vol 57, No 3, p 314-320, March 1965. 5 fig, 2 tab, 11 ref.

Descriptors: *Water treatment, *Water quality, *Filtration, *Filters, *Design, Electrolytes, Head loss, Treatment facilities.
Identifiers: *Dual media filters.

Results of operation of a conventional filter of 27 in. sand on 18 in. gravel were compared for a year with those of a dual-media filter composed of 20 in. anthracite on 6 in. sand on a 19 in. gravel bottom patterned after Baylis. These were monitored by sand leakage detectors, turbidimeters, cotton plug floc detectors, membrane filter color comparisons, bacteriologic tests, and iron, color and manganese tests, flow rates and head losses were recorded. Based on these results, an entire plant (22 filters) was converted to the multiple-bed filters with Baylis type gravel bottoms. A polyelectrolyte aid system was included in the renovation; the average dosage is 10 ppb. The multiple-bed filters with polyelectrolyte feed (alum coagulant) improved water quality at normal rates of filtration, allowed increased rates of filtration without depreciation of water quality and required less alum and less water for backwashing filters. The multiple-bed filter process is more efficient than conventional filtration. (Bean-AWWA)
W72-04570

REMOVAL OF 2, 4-DICHLOROPHENOXYACETIC ACID DERIVATIVES FROM NATURAL WATERS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Science.
O. M. Aly, and S. D. Faust.
Journal of American Water Works Association, Vol 57, No 2, p 221-230, February 1965. 7 fig, 5 tab, 17 ref.

Descriptors: *Water treatment, *Pesticides, *Toxics, Coagulation, Sedimentation, Filtration, Chlorination, Activated carbon, *Water pollution treatment, *2-4-D.
Identifiers: Potassium permanganate.

Treatment methods of chemical coagulation and oxidation by chlorine and potassium permanganate will not remove 2,4-D herbicides from water. Removal of 2-4-Dichlorophenol (2,4-DCP), from water can be achieved effectively by oxidation with potassium permanganate. Activated-carbon treatment is an effective method for the removal of 2,4-D compounds, formulation solvents, and 2,4-DCP. Strongly basic anion-exchange resins can be used for the removal of high concentrations of 2,4-D and 2,4-DCP. (Bean-AWWA)
W72-04579

EFFECT OF FILTRATION RATE ON FILTRATE QUALITY,
Hazen and Sawyer, New York.
B. A. Segall, and D. A. Okun.
Journal of the American Water Works Association, Vol 58, No 3, p 368-378, March 1966. 7 fig, 3 tab, 4 ref.

Descriptors: Water treatment, *Water quality, *Design, Turbidity, *Filtration, *Flow rates, Head loss, Treatment facilities, *Filters.
Identifiers: Anthracite filters, Sand filters, Dual-media filters.

The differences in performance of sand and anthracite media are attributable to differences in grain size and porosity of the two materials rather than the materials themselves. For influent turbidity of less than 4 (applied to filters) a rate of 3 gpm/sq ft for the anthracite medium and 4 gpm/sq ft for the sand medium were acceptable until the breakthrough occurred. When influent turbidity exceeded 4, the anthracite medium performed poorly at all rates. Another problem with the coarser medium was the poor quality at all rates during the initial operating period after backwashing. (Sand effective size (E.S.) equal to 0.57mm, uniformity coefficient (U.C.) equal to 1.38; Anthracite effective size (E.S.) equal to 0.76mm, uniformity coefficient (U.C.) equal to 1.78). The design problem is clear. A filter is required that will function efficiently at the low influent turbidity values brought about by improved coagulation, flocculation and sedimentation techniques. Such a filter would permit higher filtration rates through relatively coarse media. The maximum head loss, fixed by the hydraulics of the filter to prevent air binding, should come just before breakthrough occurs. (Bean-AWWA)
W72-04588

CHEMICAL NATURE OF ORGANIC COLOR IN WATER,
Washington Univ., Seattle. Dept. of Civil Engineering.
R. F. Christman, and M. Ghassemi.
Journal of the American Water Works Association, Vol 58, No 6, p 723-741, June 1966. 16 fig, 6 tab, 13 ref.

Descriptors: Water treatment, *Chemical degradation, *Color, Organic matter, Phenol, Iron compounds, Hydrogen ion concentration.
Identifiers: Aluminum.

The fundamental chemical structure of those organic molecules responsible for color in natural waters has remained a mystery. The mechanism of interaction between color molecules and hydrolytic products of aluminum or iron during coagulation will not be defined clearly until the structures of color molecules are known. The structures of the color molecules, possible sources of color, properties of color solids, fluorescence of colored water, pH-color variation, carbon content, chemical nature of wood, soil organic matter, degradation techniques and products, and chromatographic separation were investigated and a formula for hypothetic color macromolecules formulated. Organic materials responsible for color were isolated from several streams and subjected to degradative chemical action. Alkaline-CuO was effective in degrading the complex color molecules to recognizable chemical structures. Seven products were identified: vanillin, vanillic acid, syringic acid, catechol, resorcinol, protocatechuic acid, and 3,5-dihydroxybenzoic acid. These results provide conclusive evidence for the presence of phenolic nuclei in the color macromolecule. Close similarity was found between the degradation products of color and water-soluble organic components of wood and soil. No strict uniformity was found between color value and organic carbon content or in the pH-color variation patterns. (Bean-AWWA)
W72-04589

EFFECTIVENESS OF WATER TREATMENT PROCESSES IN PESTICIDE REMOVAL,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
G. Robeck, A. Dostal, J. M. Cohen, and J. F. Kreissl.
Journal of American Water Works Association, Vol 57, No 2, p 181-199, February 1965. 13 fig, 13 tab, 26 ref.

Descriptors: *Water treatment, *Pesticides, *Toxins, Coagulation, Sedimentation, Filtration, Activated carbon, Chlorination, Ozone, *Water pollution treatment, *DDT, *2-4-5-T, *Dieldrin, *Endrin.

Pilot plant studies were made on the effectiveness of treatment processes in removing DDT, lindane, parathion, dieldrin, 2,4,5-T ester and endrin. Accumulative removals are shown in a table. These results show that each part of a water plant may have potential for reducing certain pesticides. DDT was easily removed by settling and coagulation followed by filtration. Lindane and parathion were not. Chlorine and potassium permanganate at 1-5 ppm did not reduce chlorinated hydrocarbons. These oxidants did convert parathion to a different but more toxic compound (paraoxon). At relatively large and impractical concentrations, ozone did reduce chlorinated hydrocarbons somewhat, but byproducts formed and their toxicity is unknown. (Bean-AWWA)
W72-04594

VIRUS INACTIVATION IN WATER-SOFTENING PRECIPITATION PROCESSES,
Maine Univ., Orono. Dept. of Civil Engineering.
S. E. Thayer, and O. J. Sproul.
Journal of American Water Works Association, Vol 58, No 8, p 1063-1074, August 1966. 5 fig, 5 tab, 25 ref.

Descriptors: Water treatment, *Viruses, *Disinfection, *Calcium carbonate, Lime, Sodium compounds, Magnesium hydroxide, Hardness (Water), Water softening.

The nature and extent of the effect that water-softening precipitation processes have on bacterial virus were studied. The various processes inactivate the T2 bacteriophage, the extent of inactivation varies widely and is dependent mainly on the type and amount of precipitate formed. The standard excess-lime-soda ash process produced at least 99.95 per cent virus inactivation; addition of less than recommended amounts of excess lime resulted in increase in the per cent virus remaining. Calcium carbonate must be formed in the presence

of the virus to effect a significant degree of inactivation. With water of 300 mg/l hardness, straight lime softening produced an average of 60 per cent virus inactivation, and straight soda ash softening resulted in about 90 per cent inactivation. When magnesium hydroxide was the one precipitate formed, virus inactivation was in the order of 99.999 per cent. This effect is believed due to the ability of the hydroxide to continue to inactivate virus after the chemical formation of the floc. (Bean-AWWA)
W72-04602

VIRUS DISPERSAL BY WATER,
Hospital for Sick Children, Toronto (Ontario).
D. M. McLean, J. R. Brown, and R. Laak.
Journal of American Water Works Association, Vol 58, No 7, p 920-928, July 1966. 5 tab, 14 ref.

Descriptors: Water treatment, Water quality, *Virus, *Aeration, *Chlorination.
Identifiers: *Bromine, *Iodine.

Movement of water in creeks induces rapid dilution and thereby disperses virus infectivity, but virus concentration in stagnant lake water remains relatively unchanged for considerable periods. Relatively slow reduction of infectivity of poliovirus-3 occurred following its introduction with sewage into an aeration tank on continuous flow operation. Virus appeared in the effluent during the succeeding five days. Columns constructed of sand or soil freely permitted the passage of poliovirus-3. Maintenance of adequate residuals of free chlorine, bromine and iodine promoted the rapid inactivation of poliovirus-2 following its injection into swimming pool water. (Bean-AWWA)
W72-04603

CHLORINATION OF WASTEWATER EFFLUENTS,
Cornell Univ., Ithaca, N.Y. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05D.
W72-04618

PESTICIDES AND OTHER CONTAMINANTS IN RAINFALL AND RUNOFF,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
S. R. Weibel, R. R. Weidner, J. M. Cohen, and A. G. Christianson.
Journal of the American Water Works Association, Vol 58, No 8, p 1075-1084, August 1966. 1 fig, 5 tab, 6 ref.

Descriptors: *Water quality, *Rainfall, *Runoff, *Pesticides, *Suspended load, Phosphates, Nitrogen, Biochemical oxygen demand, Chemical oxygen demand.

Solids, nutrients, and COD concentrations in rain are low, however, they may equal or exceed thresholds known to be associated with algae nuisances in lakes. Pesticides are transported in the air and deposited in areas remote from the points of application, especially where there are high winds and dust clouds. Rainwater atop the Taft Center in Cincinnati contained 1.3 microgram/l of DDT. Suspended solids, chemical oxygen demand, biochemical oxygen demand, PO4, Total N, and coliform organism content of various runoff are given. Organic chlorine content of two runoffs were 1.7 and 0.43 microgram/l, both many times the threshold levels associated with algae blooms. (Bean-AWWA)
W72-04632

COLIFORM ORGANISM REMOVALS BY DIATOMITE FILTRATION,
Rutgers - The State Univ., New Brunswick, N.J.
J. V. Hunter, G. R. Bell, and C. N. Henderson.
Journal of the American Water Works Association, Vol 58, No 9, p 1160-1169, September 1966. 2 fig, 7 tab, 4 ref.

Descriptors: Water treatment, *Water purification, *Filtration, *Coliforms, Flow rates, Iron compounds.
Identifiers: Diatomite filters, Filter aids.

The more permeable the filter aid, the greater the number of coliform organisms in the effluent for any stated level in the influent. Some types of filter*aid give complete removal up to influent levels of several thousand coliform per 100 ml and within limits of relatively short filter runs; the influent level increases as the permeability of the filter aid decreases. Once past the level that allows complete coliform removal, the greater the coliform level in the influent the greater the coliform level in the effluent. Even the most permeable filter aid tested gave coliform removals of greater than 50 per cent for influent coliform levels of 210 to 1,300 per 100 ml. Increasing the flow rate from 1 to 2 gal/sq ft/min. did not significantly alter the coliform reductions. Changing the body feed rates from 7.5 to 30 to 60 ppm did not significantly alter the coliform reductions. Addition of iron salts prior to filtration gives significantly higher coliform removal than without the iron salts, provided that the iron is removed by the filter. (Bean-AWWA)
W72-04639

TREATMENT FOR HIGH IRON CONTENT IN REMOTE ALASKAN WATER SUPPLIES,
Arctic Health Research Center, College, Alaska.
B. E. Benson.
Journal of the American Water Works Association, Vol 58, No 10, p 1356-1362, October 1966. 3 fig, 1 tab, 5 ref.

Descriptors: *Water treatment, *Water wells, *Iron, *Manganese, *Hardness (Water), *Water softening, Lime, Sedimentation, Chlorination, Disinfection.

The high iron and manganese content of well waters in Alaska is being reduced by batch lime treatment, settling and decantation, with aeration in some cases. At Napakiak, Minto and Akiachak with water iron contents of 110, 69, and 174 ppm Fe, respectively these treatments reduced the content to 0.5, 0.4, and 0.32 ppm Fe, and the manganese to 0.25, 0.04 and 0.06 ppm Mn respectively. Total hardness was reduced from 470, 333 and 400 ppm respectively, to 56, 122 and 83 ppm. Methods had to be simple because of the manpower available. Field tests were developed for control since transportation of samples to laboratories required several days and changes in CO2, pH and alkalinity made the laboratory tests unreliable. Installation of filters to remove the minute remaining amounts of iron or manganese is not considered justified. The treated water is free of chlorine demand; chlorine added up to 2 mg/l remained as free residual chlorine. Disinfection is accomplished by adding calcium hypochlorite (HTH). (Bean-AWWA)
W72-04640

DEVELOPMENT OF OPTIMIZATION MODELS FOR CARBON BED DESIGN,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
K. A. Dostal, J. J. Harrington, R. M. Clark, and G. G. Robeck.
Journal of the American Water Works Association, Vol 58, No 9, p 1170-1186, September 1966. 10 fig, 6 tab, 13 ref.

Descriptors: Water treatment, *Activated carbon, *Filters, *Filtration, Taste, Odor, Organic matter, *Model studies, Treatment facilities.

Initial intent was to develop optimization models for a system designed to remove taste- and odor-producing materials from water. Incorporation of all treatments presently used in such a model was impossible because of lack of both performance and cost data. Therefore the study was narrowed to activated-carbon beds or adsorbers for removal of dissolved organic materials from water. The development of technologic functions from experimental data and the incorporation of these and pertinent economic data in mathematical optimization models are discussed. These models include cases with constant influent quality over the year, as well as those with seasonal changes in influent quality. A model must consider many items, including equilibrium capacity and kinetics of adsorption, type of treatment to remove inorganics, whether continuous or intermittent reactivation, loss of carbon due to physical attrition in reactivation, loss in capacity of carbon with successive reactivation cycles, size of the filter, size of the furnace for reactivation, and wasting of carbon that had become too contaminated with inorganic materials, and cost of carbon, gas, or steam. (Bean-AWWA)
W72-04641

GASTROENTERITIS EPIDEMIC OWING TO SEWAGE CONTAMINATION OF PUBLIC WATER SUPPLY,
California State Dept. of Public Health, Berkeley.
For primary bibliographic entry see Field 05B.
W72-04642

CONTAMINATION OF RIVERSIDE, CALIF. SUPPLY,
Riverside Public Utilities Dept., Calif.
For primary bibliographic entry see Field 05B.
W72-04643

SELECTIVE REMOVAL OF MIXED PHOSPHATES BY ACTIVATED ALUMINA,
Oak Ridge National Lab., Tenn.
W. C. Yee.
Journal of the American Water Works Association, Vol 58, No 2, p 239-247, February 1966. 5 fig, 2 tab, 16 ref.

Descriptors: Water treatment, *Phosphates, *Adsorption, Sodium hydroxide, Filtration, Water pollution treatment, Detergents, Fertilizers, Phosphorous compounds.
Identifiers: *Activated alumina.

The forms of phosphate normally introduced into water streams as detergent and fertilizer wastes may be selectively sorbed by a column of activated alumina. The forms of phosphate studied were orthophosphate, tetra-sodium pyrophosphate, penta-sodium tripolyphosphate, sodium hexametaphosphate, and sodium phosphate. Capacity estimates were made with three commercial grades of activated alumina. Regeneration of the exhausted alumina beds was achieved by putting the column into a closed loop and eluting the sorbed phosphates by upflow recirculation of sodium hydroxide at velocity sufficient to fluidize the bed. More than 99 per cent removal was accomplished using tap water solutions containing 5-25 ppm of each type of phosphate. Such columnar sorption did not alter the chemical composition of the treated water in the pH range tested. The increasing consumption of both phosphate-containing fertilizers and organic detergents makes this process an increasingly important one. (Bean-AWWA)
W72-04644

STUDIES OF MODIFICATIONS IN TREATMENT OF LAKE ERIE WATER,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
K. A. Dostal, and G. G. Robeck.
Journal of American Water Works Association, Vol 58, No 11, p 1489-1504, November 1966. 15 fig, 5 tab, 15 ref.

Descriptors: Water treatment, *Flocculation, *Sedimentation, *Filtration, Flow rates, Head loss, Treatment facilities.
Identifiers: *Dual media filters.

Studies conducted for 1 year at the West Plant, Erie, Pa., utilized two 4 in. diameter experimental filters capable of operating to an 8 ft total head loss. The filters were equipped with backwash and surface wash facilities. Bed depth was 24 in., with 18 in. of coal over 6 in. of sand. During all the runs, raw water was added to the constant-head box and alum was fed into the line connecting the constant-head box and filter proper. During the study, Lake Erie water was filtered through the dual-media filters without flocculators or sedimentation basin. A high-quality effluent was produced with the addition of 5 to 15 ppm of alum. The quality was maintained at filtration rates of 2 to 6 gpm/sq. ft. Removal of coal particles finer than 1.2 to 1.4 mm appears to result in the optimum coal size. With floc penetration into the coal layer, mixing of the sand and coal at the interface allows more efficient use of the storage space in the media and thus, longer runs. Because a very good effluent can be produced with these treatment modifications, cost comparisons with other alternatives should be made before any plant expansions. (Bean-AWWA)
W72-04645

SPLIT-TREATMENT WATER SOFTENING AT DAYTON,
Florida Univ., Gainesville. Dept. of Chemistry.
A. P. Black.
Journal of American Water Works Association, Vol 58, No 1, p 97-106, January 1966. 3 fig, 6 tab, 4 ref.

Descriptors: Water treatment, *Magnesium, *Lime, *Water softening, Hydrogen ion concentration, Filtration, Carbon dioxide, Ohio, Treatment facilities.
Identifiers: *Dayton (Ohio).

The economical reduction of magnesium hardness by split treatment is described. Two units operating in series are required. Seventy-five percent of the raw water to be treated is passed to the first unit, with enough lime added to remove all the magnesium. This requires an excess of about 70 ppm caustic alkalinity and pH of 11.1-11.3, depending on the temperature of the water. The bulky sludge containing gelatinous Mg (OH)2 settles to produce a very clear effluent. Ample primary sludge should be returned to the primary unit. The clear settled effluent of the primary unit is passed to the secondary unit, where it is mixed with 25 per cent of raw water and returned secondary sludge. The large lime excess in the clear settled water from the primary stage is used completely to remove only calcium hardness from the added secondary raw water. The final alkalinity of the settled secondary water is as low as that provided by a split recarbonation treatment. In some cases it is possible to maintain this pH at the stability point and eliminate any recarbonation. This treatment has been compared in a Dayton, Ohio plant with two other treatments over a period of years with favorable results. (Bean-AWWA)
W72-04646

CHLORINATION OF GROUNDWATER SUPPLIES,
California State Dept. of Public Health, Berkeley. Bureau of Sanitary Engineering.
H. B. Foster, Jr., and C. L. Young.
Journal of American Water Works Association, Vol 58, No 11, p 1471-1474, November 1966.

Descriptors: Water treatment, *Diseases, *Public health, *Water reuse, *Groundwater recharge, *Chlorination, California.

Two recent outbreaks of waterborne intestinal-disease in California make it necessary to reassess and reevaluate present concepts and consider any changes that may be necessary to serve safe, wholesome, and potable water. Also, due to depletion of ground waters, reuse is becoming a necessity and the State must develop means of replenishing its underground basins with good-quality water. Pathogens and toxic chemicals may not be effectively removed by passage through soil, therefore subsurfaces filtration cannot be solely relied on to maintain safety. The efficacy and desirability of requiring that all water be chlorinated is discussed. Although chlorination may improve the bacteriologic quality, there are indications that the public is not ready to accept water taken from a basin where extensive reclaimed-sewage recharge is practiced. Waterborne outbreaks in the United States since 1920 were reviewed. Major outbreaks generally involved systems serving populations of 1,000-5,000 persons, and probably operated by a limited number of trained personnel. About 40 per cent of the outbreaks were due to contamination of a well supply. About 12 per cent were caused by cross-connections and other hazards in the distribution system. (Bean-AWWA)
W72-04647

ELIMINATION OF NITROGEN TRICHLORIDE IN DECHLORINATION PRACTICE,
Brantford Public Utilities Commission (Ontario).
D. B. Williams.
Journal of American Water Works Association, Vol 58, No 2, p 248-254, February 1966. 8 ref.

Descriptors: Water treatment, *Chlorination, *Nitrogen compounds, *Ammonia, *Sulfur compounds, *Odor, Hydrogen ion concentration.
Identifiers: Nitrogen trichloride, *Dechlorination.

The determination of nitrogen trichloride, its formation in water, organically combined nitrogen, free ammonia reactions, sulfur dioxide and ammonia control, effects of elevating the pH and mixed residuals are discussed. Several methods are useful in overcoming the NCL3 problem that causes odor in water. These include aeration, activated-carbon filtration, dechlorination by SO2 in conjunction with the use of NH3 and Cl2 to produce a final chlorine-ammonia residual, and dechlorination of HOCL by NH3, with the attendant procedure of adjusting the final chlorine-ammonia residual. The degree of success will vary considerably, depending on the type of plant, raw water conditions and level of free-residual chlorination being applied. Plant chemist must evaluate the methods in relation to these factors. (Bean-AWWA)
W72-04648

CHEMICAL CONTROL OF CORROSION,
Illinois State Water Survey, Urbana.
T. E. Larson.
Journal of American Water Works Association, Vol 58, No 3, p 354-362, March 1966. 2 fig, 5 ref.

Descriptors: *Water treatment, *Water quality, *Corrosion, *Calcium carbonate, *Oxygen, *Costs, *Inhibitors.

The need for corrosion control is discussed, oxygen as a corrosive agent, use of calcium carbonate, influence of other minerals, electrochemical corrosion, oxygen diffusion, effect of flow rates, and other influences. Chemical control of corrosion must be considered as an alternative to a variety of consequences. It is most effective as a supplement to other protective measures. Because of the variety of water qualities and of environments it is subject to many interesting complications. The application of chemical control may be limited by cost; its effectiveness may be limited by the nature of the distribution system. In the public water utilities the range of measures for chemical control is limited by the undesirable effects that certain inhibitors have on quality. (Bean-AWWA)
W72-04649

OPTIMUM DESIGN AND OPERATION OF DIATOMITE FILTRATION PLANTS,
Metcaff and Eddy, Inc., Boston, Mass.
J. H. Dillingham, J. L. Cleasby, and E. R. Baumann.
Journal of American Water Works Association, Vol 58, No 6, p 657-672, June 1966. 3 fig, 5 tab, 8 ref.

Descriptors: Water treatment, *Filtration, *Filters, *Design, *Diatomaceous earth, Digital computer, Flow rate, Head loss, Costs, *Operations research, Treatment facilities, Model studies.
Identifiers: Filter aid, Body feed, *Diatomite filters.

Designers have stressed plant designs that are adequate to meet demands, but have neglected the possibility of operating the plants at minimum cost. This study developed and demonstrated the use of a digital-computer program that could be used in the design of diatomite filtration plants that would operate at optimum economy. A Program for Optimization of Plant Operation (POPO) has been developed; it requires pilot plant tests of the filtrability of the water. POPO has tremendous potential application in the design of diatomite filtration plants and in optimization of operations of existing plants. The combination of flow rate, body feed concentrations, and terminal head loss that results in least cost depends entirely on the particular situation and can vary considerably. Optimum combination and cost of filtration depends primarily on the filtrability of the water. Optimum design of filtration plants for waters of high filtrability will occur at high filtration rates, low body feed concentrations, and low terminal head losses. As filtrability decreases optimum design will gradually change to low filtration rates, high body feed concentrations, and high terminal losses. (Bean-AWWA)
W72-04650

CONTINUOUS FOAM FLOTATION FOR WATER CLARIFICATION,
Illinois Inst. of Tech., Chicago. Dept. of Civil Engineering.
R. B. Grieves, and S. M. Schwartz.
Journal of American Water Works Association, Vol 58, No 9, p 1129-1136, September 1966. 3 fig, 2 tab, 6 ref.

Descriptors: Water treatment, *Foam separation, *Air, *Electrolytes, Turbidity, *Water purification, *Flotation, Foaming.

The foam flotation process involves the addition to the raw water of a cationic surface-active agent which is adsorbed on the negatively-charged colloidal particles that give the water turbidity, or apparent color, or both. The particles, which have been made oleophilic (hydrophobic), readily attach themselves to air bubbles, and are floated to the surface by diffusing air through the water. A stable foam is formed above the water, it is continuously removed, leaving a clarified water. The process has a good deal of potential for small municipalities with water of 100 units turbidity or greater. It could replace the coagulation-sedimentation steps of conventional treatment processes. A rough operating cost analysis for two waters is 15 cents and 28 cents per 1,000 gallons. Further studies should be conducted. These should include multi-column operation, the use of other surfactants, variation of surfactant-bentomite combinations, and modified operating conditions. (Bean-AWWA)
W72-04651

EXPERIMENTS WITH PLASTIC PREFILTER MEDIA,
Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.
J. E. Kerrigan, and L. B. Polkowski.
Journal of American Water Works Association, Vol 57, No 1, p 85-98, January 1965. 9 fig, 4 tab, 10 ref.

Descriptors: *Water treatment, *Filtration, *Design, Head loss, Filters.
Identifiers: *Plastic filter media, *Dual filter media.

Experimental studies on filtering performance were conducted with Eau Claire sand, effective size 0.50 mm, and a layer of plastic spheres above the sand. These were 1.5 mm cellulose acetate spheres with specific gravity between 1.2 and 2.0. Filter runs were terminated at head loss of 7.65 ft. and effectiveness of the prefilter medium was measured in terms of filter performance expressed in gallons per square foot per run. There was an increase in filter performance with increase in depth of the prefilter media; the increase was greater between 0 and 1 in. depth than between 1 and 2 in. depth. At conventional rates of filtration the greater depths of prefilter had a greater effect than a rate increase to 3 gpm/sq ft. The prefilter medium removed a portion of the suspended solids from the filter influent, thus reducing the solids carried to the sand bed. The deposit of solids in the sand layer was similar for both filter bed conditions, with or without prefilter media. The prefilter media, removes a portion of the suspended solids without creating appreciable loss, and this permits the filter run to be increased before terminal head loss in the sand bed is developed. (Bean-AWWA)
W72-04691

DEFLUORIDATION OF DRINKING WATER IN SOUTHERN CALIFORNIA,
Engineering-Science, Inc., Arcadia, Calif.
J. A. Harmon, and S. G. Kalichman.
Journal of American Water Works Association, Vol 57, No 2, p 245-254, February 1965. 3 fig, 3 tab, 6 ref.

Descriptors: *Water treatment, *Fluorides, *Filtration, *Ion exchange, Phosphates, *Water purification.
Identifiers: Activated alumina, Bone char, Bone meal, Polystyrene, Mixed media, Defluoridation.

In southern California 28 water systems, with 200 or more service connections, have one or more sources containing 1.0 ppm or more fluoride, and some have over 3 ppm. California allows mean monthly concentrations of fluoride, in relation to mean annual temperature as follows: 50 deg F, 1.5 ppm; 60 deg F, 1.0 ppm and 70 deg F, 0.7 ppm. Since the mean temperatures in southern California are high, more than a quarter million people are served water above the regulations. Defluoridation media used in plants are tricalcium phosphate, (3), bone char (5), bone meal (1), activated alumina (1), mixed bed demineralizer which removes fluorides and other minerals (1). The media in the latter filters are sulfonated polystyrene and quartenary amine polystyrene. Regeneration of media is incorporated into 7 plants. The other four require media replacement when exhausted. Regeneration procedure generally is a cycle backwash, caustic wash, caustic rinse, acid neutralization and rinse. Plant equipment is a collection of standard water treatment plant items, the cost and complexity are identical to softening or ion-exchange plants, and problems are no more difficult than those in conventional water treatment plants. (Bean-AWWA)
W72-04694

DIATOMITE FILTERS FOR MUNICIPAL USE.
American Water Works Association, New York. Task Group 2710P.

Journal of American Water Works Association, Vol 57, No 2, p 157-180, February 1965. 5 tab, 178 ref.

Descriptors: *Water treatment, *Filtration, *Diatomaceous earth, *Design, *Standards, *Water quality.
Identifiers: Diatomite filters.

Diatomite filter systems can be sucessfully used in the production of potable water for municipal use. A diatomite filter can effectively remove suspended substances from water and can produce water of equal or better clarity than conventional rapid sand filters. Good standards and technical guidance are needed by the designer and user. Recommendations are that AWWA continue development of technical data, and prepare standards of design and operation. Also, AWWA should encourage studies and field research to determine: the type and optimum dose of body feed for various raw water characteristics; the effectiveness of chemical treatments of applied water to improve its filterability and means of measuring filterability; and the operating efficiency for comparison with conventional filters. (Bean-AWWA)
W72-04696

5G. Water Quality Control

PROGRESS REPORT ON WATER QUALITY CRITERIA,
American Water Works Association, New York. Task Group 2225M.
E. L. Bean.
Journal of the American Water Works Association, Vol 54, No 11, p 1313-1331, November 1962. 1 tab, 24 ref.

Descriptors: *Water purification, *Public health, *Water quality, Quality control, *Standards.

AWWA Task Group 2225 M presented a functional definition of 'ideal quality water', the characteristics of such, and maximum concentration of materials present in such waters. The rationale behind the choice of limits is given. Methods of analysis are discussed; new methods of bioassay and determination of the corrosion and scaling characteristics by test coupons are presented. The purpose of the proposed ideals is to apply relevant established criteria to the physical, chemical, bacteriological, and other statistical records, in order to establish objectively the relative quality standing of a water. (Bean-AWWA)
W72-04120

THE WELFARE ECONOMICS OF WATER RESOURCE ALLOCATION OVER TIME,
Purdue Univ., Lafayette, Ind.
E. Loehman, and A. Whinston.
Applied Economics, Vol 2, No 2, p 75-99, 1970. 4 fig, 19 ref. OWRR B-020-IND.

Descriptors: *Water utilization, *Welfare (Economics), *Optimization, *Time, Resource allocation, Taxes, Legal aspects, Mathematical models.
Identifiers: Externalities.

The Pontryagin Maximum Principle is applied to the case of technological externalities to determine the optimal allocation of water resources over time. Two producers, one upstream from the other, are considered. The externality is assumed to be effluent discharge by the upstream producer which increases the production costs of the downstream producer. The necessary optimality conditions for a Pareto efficient water resource allocation are found by maximizing joint profits subject to profit maximizing constraints. The optimal dumping level for the polluter is allowed to increase only when the river's flow is sufficiently large. If flow is constant, the polluter's production level is constant only if the damage due to the last unit of output equals marginal revenue; otherwise, the polluter's production should decrease. If flow decreases, the polluter's production level must also decrease. The production levels implied by these optimality conditions should be imposed by a central authority through legal restrictions and property rights rather than taxes. Such impositions would encourage the firms to enter into negotiations and cooperate in building a treatment plant. Thus, certain conditions imposed by a central authority can result in even greater social welfare through decentralized joint decision-making by the firms. (Settle-Wisconsin)
W72-04121

EFFECTIVENESS OF WATER UTILITY QUALITY CONTROL PRACTICES,
Public Health Service, Washington, D.C. Div. of Environmental Engineering and Food Protection.
F. B. Taylor.
Journal of the American Water Works Association, Vol 54, No 10, p 1257-1264, October 1962. 3 tab.

Descriptors: *Water treatment, *Water quality control, *Standards, *Water quality, Groundwater.

Selected data from both surface and ground water supplies were used to assess the effectiveness of quality control by comparing the quality obtained with the 1962 USPHS Drinking Water Standards. On up to 172 water supplies, values are presented for the number of supplies containing various ranges of concentration of alkylbenzene sulfonates, arsenic, barium, cadmium, carbon chloroform extracts, chloride, chronium (hexavalent), copper, fluoride, iron, lead, manganese, nitrate, selenium, sulfate, total dissolved solids, zinc, turbidity, color, threshold odor number, radium-226, strontium-90 and gross beta activity. The items also are shown in terms of range and mean which are compared to the Drinking Water Standards in a tabulation. (Bean-AWWA)
W72-04140

WATER QUALITY STANDARDS, LAS VEGAS WASH.
Nevada State Dept. of Health, Welfare and Rehabilitation, Carson City. Bureau of Environmental Health.

1970. 8 P, 4 TAB.

Descriptors: *Water quality, *Standards, *Sewage effluents, *Nevada, Water temperature, Hydrogen ion concentration, Dissolved oxygen, Biochemical oxygen demand, Chemical oxygen demand, Suspended load, Phosphorus, Phosphates, Nitrogen, Nitrates, Nitrites, Turbidity, Coliforms, Taste, Odor, Color, Oil, Bottom sediments, Radioisotopes, Nutrients.
Identifiers: *Las Vegas Wash (Nev), Methylene blue active substance, Orthophosphates, Polyphosphates.

Both interim and permanent water quality standards are given for two points on the Las Vegas Wash: (1) 3 yards downstream from the Clark County Sanitation District's sewage treatment plant outfall structure and (2) 3 yards downstream from the City of Las Vegas sewage treatment plant outfall structure. The interim standards are to be effective July 1, 1973 and the permanent standards January 1, 1980. (Mortland-Battelle)
W72-04147

DISPERSION MODEL FOR A STREAM WITH SEVERAL WASTE INPUTS AND WATER INTAKES,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 06A.
W72-04158

DIRECT FIELD DETERMINATION OF THE NATURAL REAERATION COEFFICIENT BY FREQUENCY RESPONSE ANALYSIS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Chemical and Biochemical Engineering.
Y. S. Shieh. and B. Davidson.
Water Resources Research, Vol 7, No 6, p 1522-1528, December 1971. 4 fig, 1 tab, 7 ref. OWRR B-019-NJ.

Descriptors: *Dissolved oxygen, *Water analysis, *On-site tests, *Oxygen demand, Aeration, Path of pollutants, Systems analysis, Analytical techniques, Frequency analysis, Mathematical studies, Mathematical models, Water pollution control.

By means of a mechanical instream aerator operated in a sinusoidal fashion with a known amplitude and frequency, it is possible to determine quantitatively the value of the natural reaeration coefficient from chosen field measurements of dissolved oxygen (DO) concentration. The method uses a mechanical aerator as a boundary condition in conjunction with a detailed one-dimensional, unsteady state Streeter-Phelps model of a polluted river. By means of an analysis of the DO variation with time at a fixed distance downstream from the forcing function at the end of the transient period, the natural reaeration coefficient can be uncoupled parametrically from the bichemical removal coefficient, the benthal demand factor, and the respiration term. (Knapp-USGS)
W72-04159

REGIONAL ENVIRONMENTAL POLLUTION OPERATIONS PLAN.
Tulsa City-County Health Dept., Okla. Environmental Health Div.
For primary bibliographic entry see Field 05B.
W72-04206

2020 VISION/2, A LOOK AT WASTEWATER DISPOSAL 50 YEARS HENCE,
For primary bibliographic entry see Field 05D.
W72-04232

QUALITY GOALS FOR POTABLE WATER; STATEMENT OF POLICY.
American Water Works Association, New York. Water Quality Goals Task Group.
For primary bibliographic entry see Field 05F.
W72-04239

AN ECONOMIC MODEL FOR A POLLUTED RIVER SYSTEM,
Water Resources Board, Reading (England).
V. K. Collinge, D. H. Newsome, A. L. Downing, and J. Renold.
Paper presented at the 5th International Water Pollution Research Conference, July-August, 1970. 6 p, 3 fig, 4 ref.

Descriptors: *Economic efficiency, *Model studies, *River systems, *Biochemical oxygen demand, *Dynamic programming, Linear programming, Optimization, Water quality, Water distribution, Planning, Water demand.
Identifiers: *Trent river, Streeter-Phelps method.

The objectives of the proposed economic model for a polluted river were to determine different ways in which the river Trent and its tributaries could be used to satisfy the expected demand for water for domestic, industrial, agricultural and amenity uses, and to evaluate the costs and benefits of each of these ways as a guide to determining the most efficient solution. A quality state was defined by dividing the river into appropriate reaches and deriving the probability/concentration curves for each constituent. The degree of risk attached to the assumption that the river was in a particular quality state was assessable in terms of each constituent. Surveys were carried out to determine the effects of pollution on water quality in the Trent system and the Streeter-Phelps method of calculating oxygen deficits and BOD distributions was used. A computer model was constructed which evaluated alternative patterns of water development on and off the river. Dynamic Programming was proposed as a means of solving the multi-decision process problem. (Ligon-Cornell)
W72-04256

PHARMACOLOGICAL TESTING OF BLUE--GREEN ALGAE FOR CONSTITUENTS HAVING THERAPEUTIC VALUE,
World Life Research Inst., Colton, Calif.
For primary bibliographic entry see Field 05C.
W72-04259

WATER QUALITY CONTROL THROUGH FLOW AUGMENTATION,
Heidelberg Coll., Tiffin, Ohio. Dept. of Biology.
David B. Baker, and Jack W. Kramer.
Available from SOD EP2.10:16080DF001/71, $0.95 in microfiche. Environmental Protection Agency, Water Quality Office, Water Pollution Control Research Series, January 1971. 156 p, 27 fig, 8 tab, 14 ref, 12 append. EPA Program 16080DF001/71.

Descriptors: *Water quality control, *Flow augmentation, Water quality, Reservoirs, Water pollution sources, Algae, River flow, Phosphorus, Nitrates, Potassium, Dissolved oxygen, Forecasting, Fluorides, Ohio.
Identifiers: Sandusky River (Ohio).

A 60-mile section of the Sandusky River, Ohio, was investigated to evaluate the relationship between the volume and the quality of flowing water. The content of fluoride, calcium, magnesium, and sodium were directly and those of total and soluble phosphorus indirectly related to the flow volume. No correlation was observed between the flow and concentration of either potassium or nitrates. Oxygen content was high at an abundant flow, but showed considerable variation, being influenced by respiration of algae. The study suggested that an increased current velocity reduces the density of algal populations. (Wilde-Wisconsin)
W72-04260

ANNUAL REPORT OF ACTIVITIES DURING FISCAL YEAR 1971.
Maine Univ., Bangor. Water Resources Center.
For primary bibliographic entry see Field 05C.
W72-04261

STRIKING THE BALANCE,
National Science Foundation, Oak Ridge, Tenn. Environmental Program; and Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 04A.
W72-04265

WORKSHOP-CONFERENCE ON RECLAMATION OF MAINE'S DYING LAKES.
Maine Univ., Bangor.
For primary bibliographic entry see Field 05C.
W72-04279

CRITERIA FOR DETERMINING ECONOMIC PRIORITIES IN AWARDING SEWAGE FACILITY CONSTRUCTION GRANTS,
Pennsylvania State Univ., University Park. Dept. of Agricultural Economics and Rural Sociology.
W. R. Kerns, and J. D. Jansma.
Available from the National Technical Information Service as PB-206 433, $3.00 in paper copy, $0.95 in microfiche. Pennsylvania Institute for Research on Land and Water Resources, Research Publication 68, June 1971, 107 p, 20 tab, 27 ref, 5 append. OWRR A-014-PA (1).

Descriptors: *Grants, *Decision making, *Utilities, *Sewage disposal, Project planning, *Economic efficiency, Economic feasibility, Economic justification, Water pollution control, *Pennsylvania.

The general objective was to examine possible alternatives to the present set of rules and regulations governing the federal and state sewage facility construction grants-in-aid program in Pennsylvania. Currently existing variations in annual sewer cost per customer were found to have an effect on service provisions and equalization needs. While economies may be gained with larger units, the larger, more urbanized areas generally require more in total services. An index of 26 selected social and economic variables which are indicative of a community's economic well-being was developed to measure the financial need component used in settling priorities for sewage facility construction grants. The application of the composite index in assigning grant priorities would result in the assigning of higher need priority rating to communities with a relatively lower economic base. Recent federal grant distributions have been based on a total need priority system. Yet, supplementary state grants were found to negate the federal priority distribution effect by making the total federal plus state grant an equal percentage of construction cost for each eligible project. This study indicates that public officials might consider the use of a flexible schedule with maximum reliance on the total relative need rating in order to permit gains in economic efficiency, as well as meeting economic equity objectives.
W72-04286

BIOPHYSICAL ENVIRONMENT AND HUMAN BEHAVIOR: LINKAGES AND FEEDBACK SYSTEMS,
Wisconsin Univ., Green Bay.
For primary bibliographic entry see Field 06B.
W72-04291

EVALUATION OF SELECTED EARTHMOVING EQUIPMENT FOR THE RESTORATION OF OIL-CONTAMINATED BEACHES.
URS Research Co., San Mateo, Calif.

Copy available from GPO Sup Doc for $1.50; microfiche from NTIS as PB-206 693, $0.95. Federal Water Pollution Control Administration, Water Pollution Control Research Series, October 1970. 169 p, 58 fig, 40 tab, 47 ref. EPA Program 15080 EQS 10/70.

Descriptors: *Oil wastes, *Beaches, *On-site tests, Water pollution control, Laboratory tests, Viscosity, Screens, Absorption, Water quality control, Transportation, Tidal waters, *Operating costs, *Earth handling equipment.
Identifiers: *Beach restoration, *Graders, *Scrapers, *Conveyors, Seaweed.

Field studies of earthmoving equipment units were conducted to evaluate their use and effectiveness in restoring oil contaminated beaches. Specifically, operating procedures and cost estimates were desired, along with any useful design modifications. Previous beach restoration operations were reviewed prior to initiation of the field tests for information about the type of performance required. The field tests were then performed on each equipment/ procedure unit to determine efficiency, flexibility, and performance characteristics under a variety of field conditions. Oil removal effectiveness was greater than 98% for all restoration procedures, with the highest effectiveness being achieved by a motorized grader and a motorized elevating scraper working in combination. On low shear strength beaches, flotation tires or steel-belted half-tracks on the motorized grader and a non-self-propelled elevating scraper with a tracked prime mover should be used. Conveyor screening systems can be effectively utilized to load oil-contaminated materials onto trucks for transport to disposal areas, separate oil sand pellets from clean sand, and partially separate oil-contaminated debris from oil-contaminated sand. Straw spread on the beach area, as well as kelp, seaweed, and similar debris presented no problem to the operation of either piece of equipment and could be readily removed by the scraper. Front-end loaders were demonstrated to have the least effectiveness for oil removal, and to remove the largest amount of material with the oil contaminated debris. Costs for removal of 0.5 gal per sq. yd. of oil from a beach tidal zone ranged from $108/acre for a motorized elevating scraper working alone, to $1540/acre for a tracked front end loader operating alone. (Lowry-Texas)
W72-04296

CHARACTERISTICS OF SEPARATED STORM AND COMBINED SEWER FLOWS,
Weston (Roy F.), Inc., Roslyn, N.Y.
For primary bibliographic entry see Field 05D.
W72-04302

THERE ARE SOME ANSWERS TO TEXTILE POLLUTION,
Warnaco, Inc., Ashaway, R.I.
For primary bibliographic entry see Field 05D.
W72-04316

THE FORMATION AND DEVELOPMENT OF A COUNTY SEWERAGE AGENCY,
Unified Sewerage Agency of Washington County, Hillsboro, Oreg.
Daniel Potter.
Journal Water Pollution Control Federation, Vol 43, No 9, September 1971, p 1855-1864.

Descriptors: *Regional analysis, *Administration, *Water districts, Oregon, Air pollution, Solid wastes, Waste water treatment, *Water quality control, Cost analysis, Financing, *Sewage district, Legal aspects.
Identifiers: Government agencies, Bond issues, Mass transportation.

The Unified Sewerage Agency of Washington County, recently formed in Oregon, marks the evolution and birth of a government agency which crosses boundaries of cities and prior special districts to ensure cooperation of the fragmented areas of government in water pollution control, air pollution control, the disposal of solid wastes, mass transportation, and other areas. The new agency assumed the responsibility of water quality control for 23 sanitary districts, 9 private systems and 10 cities, with the probability of further contracts involving areas of two other counties. The initial program for the agency included a study of the Tualatin power basin which indicated that because of low dry weather flows and anticipated population increases, a long range plan was essential to proper water quality control in the basin. A plan was developed by a consulting firm, incorporating four alternate plans of implementation. Final study boundaries encompassing 230 sq. miles and an existing population of 150,000, with a 250,000 population projected for the year 2000. A financial plan that provides for rational distribution of costs in the regional system was detailed, and as of October 1970, $3 million were commissioned in design work, and in some instances, easements were being secured for construction. (Lowry-Texas)
W72-04321

COMPUTER PROGRAMS IN USE IN THE WATER QUALITY DIVISION, VOL. 1,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 07C.
W72-04343

AN ANALYSIS OF THE RELATIONSHIP BETWEEN STREAM WATER QUALITY AND REGIONAL INCOME GENERATED BY WATER-ORIENTED RECREATIONISTS,
Pennsylvania State Univ., University Park. Dept. of Economics.
L. D. Megli, H. B. Gamble, and W. H. Long.
Available from the National Technical Information Service as PB-206 525, $3.00 in paper copy, $0.95 in microfiche. Pennsylvania Institute for Research on Land and Water Resources, University Park, Research Publication Number 69, 1971. 120 p, 15 tab, 20 ref, 2 append. OWRR B-012-PA (2).

Descriptors: *Recreation, Streams, *Pennsylvania, *Water quality, Dissolved oxygen, Hydrogen ion concentration, Temperature, Environmental effects, Economic impact, Regions, *Regional analysis, Evaluation, Recreation demand.
Identifiers: *Recreational use, *Regional income.

The hypothesis tested is: the recreational use of streams and, therefore, the amount of regional income generated by recreation-related expenditures are directly related to stream water quality in the area. Data were gathered about in-stream water quality and recreational use of streams for thirty areas of Pennsylvania. Water quality indicators were: dissolved oxygen content, pH value, and the temperature of the stream water. Information about the recreational activities and the amounts and location of expenditures related to these activities was gathered from water-oriented recreationists located along these streams. Expenditures by sector within the 'local' area were converted to estimates of regional income generated through the use of sectoral regional income multipliers adapted from an inter-industry study of a Pennsylvania county. The results indicated a positive correlation between in-stream water quality and the amount of regional income generated by recreation related expenditures. This must be qualified, however, that a decrease in recreation-derived regional income caused by a degradation of in-stream water quality is not necessarily a net decrease in regional income. This arises from the possibility of substituting another form of expenditure for the recreation-related expenditure precluded by the lower level of water quality. (Sink-Pennsylvania)
W72-04351

DISPERSION OF THERMAL EFFLUENTS,
Washington State Univ., Pullman. Coll. of Engineering.
For primary bibliographic entry see Field 05B.
W72-04352

METHOD OF RATING FLOW IN A STORM SEWER,
Geological Survey, Mineola, N. Y.
For primary bibliographic entry see Field 07B.
W72-04363

POLLUTION EVALUATION SURVEY OF THE INTERSTATE WATERS OF THE RED RIVER OF THE NORTH, NORTH DAKOTA-MINNESOTA,
Federal Water Quality Administration, Kansas City, Mo.
For primary bibliographic entry see Field 05B.
W72-04400

MEN, MONEY, AND RESPONSIBILITY IN POLLUTION CONTROL,
Continental Oil Co., Billings, Mont.
R. G. Parker.
Journal of Petroleum Technology, Vol. 22, January 1970. p 47-50, 6 ref.

Descriptors: *Water pollution, *Air pollution, Air pollution effects, Water pollution control, Costs, Data collection, Planning, *Pollution abatement, Standards.
Identifiers: Enforcement.

We all have heard many comments on how polluted our environments are becoming, and demands that something be done about it. The problem is extremely complex and there are many subleties in dealing with today's environmental problems. The acquisition of data to establish criteria, the procedures to establish fair and equitable standards and the mechanisms to maintain surveillance of the results must be accomplished to allow us to come to grips with a coordinated effort to clean up our environment. A fundamental decision must be made on the basis of just how much we as citizens and as a country are willing to pay for the desired quality of air and water, for clean air and water, whatever the definition of clean is taken to be, does not come free. In our national programs to abate pollution, we need goals, planning, realistic criteria and standards, and continued progress to replace emotion and over-reaction. We need to determine by analysis what contaminants are in our environments and what their effect are on health and property. What environmental quality do we want. How are we going to get it. How much will it cost. A proper balance of men, money, material and regulation, based on sound planning, is needed to achieve appropriate goals. Efforts to achieve these ends, if exerted promptly, will be rewarded by vastly improved environments. (Goessling-Texas)
W72-04423

EVALUATION OF ALGAL ASSAY PROCEDURES--PAAP BATCH TEST,
California Univ., Irvine. School of Biological Sciences; and California Univ., Irvine. School of Engineering.
For primary bibliographic entry see Field 05C.
W72-04433

TECHNOLOGY AND MANAGEMENT OF THE ENVIRONMENT,
Oregon State Univ., Corvallis. Water Resources Research Inst.
R. M. Alexander.
Available from the National Technical Information Service as PB-206 695, $3.00 in paper copy, $0.95 in microfiche. Technology and Management of the Environment; Seminar conducted by Oregon State University. Water Resources Research Institute, July 1971, Corvallis, Oregon, 89 p. OWRR A-999-ORE (10).

Descriptors: *Farm waste, *Waste disposal, *Water resources development, Pollution, *Industrial wastes, Reclaimed water, Ecosystems, Water pollution control, Waste water treatment, *Water management (Applied), *Environmental effects, *Planning, Water policy.

Includes eight papers presented at a weekly seminar held during the spring quarter at Oregon State University. (See W72-04563 thru W72-04570)
W72-04562

ATTITUDES, ASSESSMENTS, AND ACTION,
Oregon State Univ., Corvallis. School of Engineering.
G. W. Gleeson.
In: Technology and Management of the Environment, Water Resource Research Institute, Oregon State University, July 1971. p 1-6.

Descriptors: Farm wastes, *Water resources development, *Legislation, *Water policy, *Attitudes, Evaluation, *Environmental effects.

The adverse impact on our environment seems to be proportional to our affluence and the number of people. Unless we can cope with our population problems, all other considerations may be academic. National syndromes such as 'the bigger the better' attitude, susceptibility to mass hysteria and crash programs, unwillingness to accept the financial burden, fragmentation of research efforts, and resistance to change must all be replaced with attitudes compatible with long range planning and long time consistent effort. Any effective action needs to be multidisciplinary in nature as decisions will be political-social-economic-technical. Despite many environmental quality associations and many laws, we are still losing ground in the quality of the environment. In the area of meaningful environmental improvements we have the knowledge, the capability, and the capacity to do almost anything we want if we can specify what we want, have a reasonable consensus, are willing to accept change, are willing to pay a price, and strive to plan in long range on a system basis. (See also W72-04562) (Schmitt-Iowa State)
W72-04563

CATTLE FEEDLOTS AND ALTERNATIVES FOR WASTE MANAGEMENT,
Environmental Protection Agency, Portland, Oreg. Water Quality Office.
C. E. Veirs.
In: Technology and Management of the Environment, Water Resources Research Institute, Oregon State University. July 1971. p 65-76, 6 tab, 9 ref.

Descriptors: *Farm wastes, *Waste disposal, Water pollution sources, *Waste treatment, Waste water treatment.
Identifiers: *Feedlot runoff, *Cattle feedlots, *Waste management.

The goal of cattle feedlot and barnyard control is to prevent rural runoff by developing new or utilizing known conservation practices. The underlying cause of problems associated with cattle feedlots is people. The per capita increase in beef consumption increased 34% from 1950 to 1960. Coupled with the fact that half the people who ever lived are now alive, one can foresee the problems of waste management associated with beef production. The total waste production of animals in the U.S. is about ten times that of the current human population or about two billion tons annually. The population equivalent of cattle to man is about 6 BOD5, 12 for N, 18 for total solids, and 25 for phosphorus. Waste management alternatives include mounding in the center of a feedlot, dry storage, aerobic ponds, oxidation ditches, anaerobic lagoons, combination of aerobic and anaerobic treatment, land disposal, and land spraying. One of the considerations in the location of a cattle feedlot should be to assure sufficient land is available to dispose of the solids and liquid wastes. Provisions should also be made for dust, fly, and odor control, and for disposal of dead animals. (See also W72-04562) (Schmitt-Iowa State)
W72-04569

WATER QUALITY AND INSTREAM AERATION,
Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.
W. Whipple, Jr., and F. Dittman.
Water and Wastes Engineering/Industrial, September 1970. p E-32, E-34, 2 fig, 2 ref. OWRR B-022-NJ (6).

Descriptors: *Water quality, *Stream improvement, *Aeration, Diffusion, Temperature, Dissolved oxygen, Tertiary treatment, Organics, Nutrients, Turbidity, Biodegradation, Cost analysis New Jersey.
Identifiers: Surface aerators, *Passaic River (N.J.), *Instream aeration.

A river, considered from the viewpoint of water quality, changes its characteristics continually according to complex physical, chemical, and biological laws. The river flora and fauna react differently depending upon temperature, dissolved oxygen, organic matter and nutrients, inhibiting substances, and degree of sunlight and turbidity, as well as hydraulic flow characteristics. In seriously polluted rivers, an alternative to expensive advanced waste treatment is instream aeration. Full scale tests of instream aeration using a 75 hp surface aerator and an air diffuser with coarse bubble Link Belt diffusers installed in manifolds along the river bottom. A test section of the Passaic River was selected between Pine Brook and Two Bridges. This study indicates that, for the Passaic River, to achieve a summer level of dissolved oxygen of 4 mg/l by means of aerators would cost only one third as much as reaching the same objective by improving the many waste treatment plants. These conclusions agree with the results of similar studies of the Ruhr River in Germany. The possibilities of instream aeration have been solidly established by prototype field tests using commercial equipment. The use of instream aeration raises some interesting questions concerning levels of control and supervision and who should contribute to the costs of installation and operation. (Goessling-Texas)
W72-04580

COST OF RECLAMATION AND MINE DRAINAGE ABATEMENT-ELKINS DEMONSTRATION PROJECT,
Robert A. Taft Water Research Center, Cincinnati, Ohio.
R. B. Scott, R. D. Hill, and R. C. Wilmoth.
Available from National Technical Information Service, Springfield, Va. 22150 as PB-207 189, $3.00 in paper copy, $0.95 in microfiche. Robert A. Taft Water Research Center Report, Environmental Protection Agency, 1970. 27 p, 1 fig, 11 tab, 7 ref. (Revision of Paper 70-AG-349 presented at Soc of Mining Engineers Meeting, Oct 21-23, 1970, St. Louis, Mo). EPA Program14010---10/70.

Descriptors: *Water pollution control, *Acid mine water, *Coal mines, *Land reclamation, *West Virginia, Revegetation, Costs, Reviews.
Identifiers: Mine drainage abatement, *Elkins (W Va).

Acid mine drainage, discharging from coal beds, pollutes streams and rivers. These pollutants affect water quality by lowering the pH, reducing natural alkalinity, increasing total hardness, and adding undesirable amounts of iron, manganese, aluminum and sulfates. An acid mine drainage reclamation project was established in the Roaring Creek-Grassy Run watershed near Elkins, West Virginia. During the reclamation, 651 acres of surface mines were reclaimed, 709 acres revegetated, 55 masonry seals constructed, and 41 clay seals installed. The average overall surface mine reclamation cost was $2236/acre including $330/acre for clearing and grubbing, $1658/acre for reclamation, and $248/acre for revegetation. Overall cost for masonry seals was $4.138 each and clay seals $1,479. Stability of the reclaimed area has been exceptional as only eight small subsidence holes have occurred since 1967. Total maintenance costs have been less than $2,000 in three years; less than 0.03 percent per year of the construction cost. (Woodard-USGS)
W72-04587

THE FEDERAL WATER QUALITY PROGRAM AS IT AFFECTS THE TEXTILE INDUSTRY,
Federal Water Pollution Control Administration, Boston, Mass.
Allyn Richardson.
Textile Chemist and Colorist, Vol 2, No 10, May 20, 1970, p 171-172.

Descriptors: *Municipal wastes, *Standards, *Industrial wastes, *Textiles, *Water Quality Act, Research and development, Legislation, Financing, Cost sharing, Water pollution control, Waste water treatment.

The Federal Water Quality Act of 1965 required the establishment of water quality standards with three parts: (1) the classification of surface waters according to the uses they are intended to serve; (2) establishment of criteria for acceptable water quality standards for each class of use; and (3) a plan and timetable for implementation and enforcement of measures needed to meet the water quality requirements. Before this act, states were afraid to exercise control since industries which were forced to spend money for pollution control were at a disadvantage at the marketplace and tended to move to less restricted areas. Establishment of uniform standards eliminated this disadvantage. In addition joint treatment of wastes was encouraged by the FWPCA through their funding of up to 70% of the cost of research and demonstration grants for facilities to treat the various industrial wastes, whether the industrial wastes comprised the minor or major portion of the flow. By demonstrating their willingness to work together with industry and to share some of the cost burden, the FWPCA and the various industries are now in a position to work together to achieve the desired long range goals. (Lowry-Texas)
W72-04597

AGRICULTURAL WASTES: PRINCIPLES AND GUIDELINES FOR PRACTICAL SOLUTIONS.
New York State Coll. of Agriculture, Ithaca.
For primary bibliographic entry see Field 05D.
W72-04604

AGRICULTURE:S RESPONSIBILITIES IN A CLEAN ENVIRONMENT,
New York State Dept. of Environmental Conservation, Albany.
R. W. Pederson.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York, p 1-5.

Descriptors: *Farm wastes, *Pollution abatement, *Pesticides, *Water law ecosystems, Contaminants, Water quality control.

Agriculture's responsibilities in the all-out effort to achieve and maintain a clean environment are to recognize and understand its relationahips to other facets of the economy, to seek still greater knowledge on the 'hows' of waste management, and to apply the principles and guidelines that lead to practical solutions. Agriculture is an interlocked part of our society and culture, and our environmental problems are becoming more severe very rapidly. The new New York Department of Environmental Conservation has set goals of achieving greater effectiveness in correcting yesterday's costly mistakes, and of preventing the future degradation of our environment. Effective steps in pollution prevention mean a substantial commitment of manpower and financial resources, individual and corporate investments that aren't immediately profitable, new attitudes, and environmental conscience, and more government controls. The Department of Environmental Conservation's activities can affect land use by pesticide controls, by water supply and sewage controls for new subdivisions, controls over stream alteration, and controls over industrial plant location through permit issuance for water discharges and licensing of new air emissions. The total ecological system is very delicately interwoven and such things as the domino effect of DDT poisoning can be a very real threat to our ecology. (See also W72-04604) (Schmitt-Iowa State)
W72-04605

PESTICIDES AND PEST CONTROL IN THE FUTURE,
Cornell Univ., Ithaca, N.Y. Dept. of Entomology.
D. Pimentel.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. p 12-14, 1 ref.

Descriptors: *Farm wastes, *Pesticides, *Agricultural chemicals, *Pest control, Ecosystems, Water quality control, Regulation.

One billion pounds of pesticides were applied in the U.S. during 1970. Seventy percent was for farm use and the remaining for public and governmental use. Ninety-nine percent of the 200,000 species of plants and animals were non-target species, but many of these were affected. The Environmental Protection Agency has taken over the responsibility of pesticide regulation from the Dept. of Agriculture. In 1965, the overall return for every dollar invested in insect control with pesticides was 4 to 5 dollars, while the return per dollar invested in bioenvironmental control was 30 dollars. Development research in bioenvironmental control is slow, tedious, and costly. Prescription use of pesticides could have the advantages of expert advice, rapid distribution of new information from government agencies, more accurate control of the amounts used, and the establishment of a precautionary public attitude. Some pesticides would be banned and some applied only by state-licensed custom sprayers. Aware of the insidious destruction by pollution, the aim would be to keep the advantage of technology, but reduce the associated environmental hazards. (See also W72-04604) (Schmitt-Iowa State)
W72-04607

GUIDELINES FOR MINIMIZING PESTICIDE POLLUTION,
Cornell Univ., Ithaca, N.Y. Chemical-Pesticide Program.
R. F. Pendleton, and J. E. Dewey.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York. p 47-51.

Descriptors: *Farm waste, *Pesticides, *Pesticide drift, Pesticide toxicity, Water quality control, Phytotoxicity.

The worst aspects of pesticides are usually the most newsworthy. In order to retain the necessary use of pesticides it is imperative to use all possible means to minimize or prevent their becoming pollutants. Pesticides when properly used are tools. When they move off target or are otherwise misused they become pollutants. They become particularly important as pollutants when they move into water and cause either immediate toxicity to organisms present, or, more seriously, are of a persistent and accumulative nature and move into the food chain. Many factors contribute to pesticide drift; some physical, some climatic. The smaller the droplet and the greater the wind, the greater the drift. The choice of pesticides influence drift damage from toxicity, phytotoxicity, illegal residues, and volatilization. Choosing the right machinery for a particular job is most important. In most cases a short-lived, biologically degradable, non-cumulative compound may be substituted for an environmentally dangerous compound. Poor operational procedures and misuses are probably the greatest contribution to pesticide pollution, which can be greatly reduced through education programs involving pesticide applicator safety and known principles of conservation. (See also W7-04604) (Schmitt-Iowa State)
W72-04613

INTEGRATION OF COMPONENTS INTO A SYSTEM,
Cornell Univ., Ithaca, N.Y. Dept. of Poultry Science.
For primary bibliographic entry see Field 06E.
W72-04625

ADVISORY GROUPS FOR ENVIRONMENTAL PROTECTION AND AGRICULTURAL COOPERATION,
Wisconsin Univ., Madison. Dept of Dairy Science.
For primary bibliographic entry see Field 06E.
W72-04626

CONSEQUENCES OF MERCURY POLLUTION AND LEGAL REMEDIES,
Vanderbilt Univ., Nashville, Tenn. School of Law.
R. Nathurst.
Unpublished Law and Science Seminar Paper, 1971, 116 p. 83 ref. append.

Descriptors: *Metals, *Remedies, *Water pollution effects, *Water pollution soucces, Water pollution control, Legislation, Toxicity, Water pollution, Water pollution treatment, Human pathology, Public health, Lethal limit, Toxins, Water quality, Water quality control, State governments, Federal government, Legal aspects, Rivers and Harbors Act, Michigan, Pollutants, Pollution abatement, Industry, Mortality.
Identifiers: *Mercury, Water Pollution Control Act.

The effects of mercury pollution and possible legal remedies for it are discussed. Following a history of the physiological effects of mercury pollution three sources of mercury pollution are discussed: (1) pesticides and fungicides, (2) mercury vapor, and (3) waterborne mercury. Toxic mercury pollutants are categorized as inorganic, and organic, and conversion from one form to the other is considered. The physiological effects of mercury poisoning upon wildlife and man are also described. Various economic consequences of mercury pollution are cited, such as a loss of fish and game revenues. The author evaluates the effectiveness of the following methods of abating mercury pollution: (1) the Federal Water Pollution Control Actt, (2) state anti-pollution administrative acts, (3) citizen-suit legislation, (4) common law remedies, and (5) actions against public officers to enforce pollution laws. The Rivers and Harbors Act, and its use in combating mercury pollution, is considered. The availability of qui tam standing under the Refuse Act is considered. The 1970 Michigan Environmental Protection Act is considered in relation to mercury pollutttion control. Recommendations are made for a proposed statute to abate water pollution. (Hart-Florida)
W72-04637

DEWATERING FLORIDA PHOSPHATE PEBBLE ROCK SLIME BY FREEZING TECHNIQUES,
Bureau of Mines, Tuscaloosa, Ala. Tuscaloosa Metallurgy Research Center.
For primary bibliographic entry see Field 05D.
W72-04698

RECOVERY OF PHOSPHATES AND METALS FROM WASTE PHOSPHATE SLUDGE BY REDUCTION-SINTER PROCESSES,
Bureau of Mines, Rolla, Mo. Rolla Metallurgy Research Center.
For primary bibliographic entry see Field 05D.
W72-04699

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

DEVELOPMENT OF SYSTEM OPERATION RULES FOR AN EXISTING SYSTEM BY SIMULATION,
Corps of Engineers, Dallas, Tex.; and Corps of Engineers, Davis, Calif.
For primary bibliographic entry see Field 04A.
W72-04108

THE WELFARE ECONOMICS OF WATER RESOURCE ALLOCATION OVER TIME,
Purdue Univ., Lafayette, Ind.
For primary bibliographic entry see Field 05G.
W72-04121

ECOLOGICAL MODELS AND ENVIRONMENTAL STUDIES,
Department of the Environment, Ottawa (Ontario). Directorate of Policy Planning.
D. S. P. Puccini.
Water Resources Bulletin, Vol. 7, No. 6, p 1144-1152, December 1971. 1 fig, 16 ref.

Descriptors: *Systems analysis, *Mathematical models, *Ecology, *Environment, Simulation analysis, Aquatic environment, Environmental effects, Pollution.
Identifiers: *Cybernetic feedback loop.

The state-of-the-art of ecological modelling was assessed with a view towards developing a framework for the investigation and analysis of environmental systems. The theoretical background of ecological systems analysis, types of ecological models, a recommended approach for environmental studies and a conceptual outline for the analysis of polluted environmental systems were discussed. Examples of ecological models included the Stanford Watershed Model and Custer and Krutchkoff's stochastic estuarine model. Analytical models can best design and implement potential solutions to resource management problems. The conceptual framework presented as an approach to environmental studies and the analysis of polluted environmental systems utilized Norbert Weiner's classical cybernetic feedback loop. (Ligon-Cornell)
W72-04154

DISPERSION MODEL FOR A STREAM WITH SEVERAL WASTE INPUTS AND WATER INTAKES,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering.
L. T. Fan, R. S. Nadkarni, and L. E. Erickson.
Water Resources Bulletin, Vol. 7, No. 6, p 1210-1220, December 1971. 6 fig, 6 ref.

Descriptors: *Dispersion, *Pollution, *Streamflow, *Mathematical models, Analytical techniques, Optimization, Input-output analysis, Water quality, Biochemical oxygen demand, Dissolved oxygen, Model studies.

A useful mathematical model for prediction, management and control of water quality was proposed. An analytical solution was developed to predict the BOD and DO profiles in a stream having several outfalls of waste and intakes of water. The model also incorporated continuous addition and removal of BOD and DO along the stream. A steady state one dimensional dispersion model described the transport of BOD and DO in a stream. Changes in stream properties along the length were considered by dividing the stream into several segments and changing the parameters of the BOD and DO equations as needed in each segment. By applying continuity equations at the boundaries of these segments and equilibrium conditions at either ends of the infinitely long stream, the arbitrary constants in the solutions to the differential equations for BOD and DO were determined. Some applications of the results in studying water pollution problems were illustrated and various uses of the model were discussed. (Ligon-Cornell)
W72-04158

A PROBABILISTIC MODEL FOR AN ANNUAL OPTIMUM CONTROL OF A COMPLEX RESERVOIR,
Bulgarian Academy of Sciences, Sofia. Inst. of Technical Cybernetics.
For primary bibliographic entry see Field 04A.
W72-04254

SOME PROBLEMS OF STOCHASTIC STORAGE WITH CORRELATED INFLOW,
Technical Univ. of Warsaw (Poland). Inst. of Environmental Engineering.
For primary bibliographic entry see Field 04A.
W72-04255

AN ECONOMIC MODEL FOR A POLLUTED RIVER SYSTEM,
Water Resources Board, Reading (England).
For primary bibliographic entry see Field 05G.
W72-04256

MULTISTRUCTURED MUNICIPAL WATER DEMAND MODEL,
Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science.
G. W. Reid.
Water Resources Bulletin, Vol 7, No 6, p 1238-1245, December 1971. 7 fig, 5 ref.

Descriptors: *Population, *Systems analysis, *Municipal water, Stochastic processes, Probability, Operations research, *Water demand, Cities, *Model studies.
Identifiers: Tulsa model.

Urban water systems relate to and are influenced by a great many other systems or variables. Water cannot be looked at alone. The whole system must be considered. Population concentration and

growth rates have produced a multivariant, multistaged system involving a 'short fuse' and a high degree of uncertainty which calls for innovative approaches. Central to this system model was the development of the interactions of these systems with particular regard to resources. A demand model was described which consisted of population (or demographic model), an economic (or employment forecast model), a reconciliation, and life style model with definition of public service and private sector commitments. The model was determinative and probabilistic and in that it was articulated over time was stochastic. Due to its variability, the model was adaptable to a variety of linkage technical models or procedures to produce municipal and industrial water requirements. Several techniques had been suggested for deployment and the Tulsa model was considered. A part or all of the economic and technology models may be reliably used to develop projected needs for municipal water which were the prime objectives of this study. In summary, a very flexible demand model capable of impacting was developed and could be used as a tool on a wide variety of supply-demand studies. (Ligon-Cornell)
W72-04257

RESERVOIR OPERATING POLICY IN RELATION TO INFLOW PREDICTION,
Technical Univ. of Warsaw (Poland).
For primary bibliographic entry see Field 04A.
W72-04258

ESTIMATION OF LAKE FLUSHING RATES FOR WATER QUALITY CONTROL PLANNING AND MANAGEMENT,
Maine Univ., Orono. Water Resources Research Center.
For primary bibliographic entry see Field 02A.
W72-04283

LAW AND THE ECOSYSTEM: DOES NATURE HAVE A LEGAL PERSONALITY,
Wisconsin Univ., Green Bay.
For primary bibliographic entry see Field 06E.
W72-04290

BIOPHYSICAL ENVIRONMENT AND HUMAN BEHAVIOR: LINKAGES AND FEEDBACK SYSTEMS,
Wisconsin Univ., Green Bay.
For primary bibliographic entry see Field 06B.
W72-04291

HONEY HILL: A SYSTEMS ANALYSIS FOR PLANNING THE MULTIPLE USE OF CONTROLLED WATER AREAS,
Harvard Univ., Cambridge, Mass. Dept. of Landscape Architecture.
T. Murray, P. Rogers, D. Sinton, C. Steinitz, and R. Toth.
Institute for Water Resources, Dept of the Army Corps of Engineers, Report 71-9, October 1971, Vol 1 and Vol 2 (Appendix). 726 p, 153 fig, 229 tab, 168 ref, 13 append. DACW 33-69-C-0128.

Descriptors: *Environmental effects, *Systems analysis, *Cost-benefit analysis, *Recreation demand, Ecology, Wildlife, Water quality, Models, Simulation analysis, New Hampshire, Sites.
Identifiers: *Computer graphics, *Honey Hill (N.H.).

The authors focused their attention on ways and means for measuring non-monetary social and environmental costs and benefits and comparing them with costs and benefits measurable in dollars. They also developed a better way to plan for the multiple use of water and related land resources with emphasis on recreation uses. The data on the area were stored, analyzed and displayed using computer graphics techniques developed by the investigators. The study developed sets of quality indices for visual quality, ecological damage, wildlife habitat, etc. Grid areas were evaluated and ranked in terms of various uses, thus laying the basis for a planning evaluation process for site development. A simulation model was developed which allowed for comparison of the effects over time of alternative recreation plans. Alternatives were developed and tested in the model utilizing both 'best professional judgment plans' and alternatives derived from a mathematical programming model developed by the authors. (Ligon-Cornell)
W72-04544

THE NATIONAL MANAGEMENT OF WATER RESOURCES,
Water Resources Board of England and Wales.
N. Rowntree.
Effluent and Water Treatment Journal, Vol 11, No 11, p 601-606, November, 1971.

Descriptors: *Water management, *Water policy, *Water pollution control, *Water resources, *Simulation analysis, Storage, Reservoirs, Model studies.
Identifiers: River Dee, River Trent, England, Wales.

The development of regional water plans has disclosed the opportunities for choices between patterns of development and the considerable difficulty of making complicated decisions. In this respect, the computer has been of enormous help. Simulation in modelling techniques, physical, analogue or digital have proved to be powerful tools for examining problems involving interpretation from masses of observational data which are rarely comprehensive and vary in accuracy. The types of problems dealt with in this manner are illustrated by the Dee River and the Trent River. The object of the Dee River program was aimed at using the storage in the regulating reservoirs for the overall advantage of the river. The digital simulation model of the river enabled the longer term regulation pattern to be developed in conjunction with the optimization models being developed. A mathematical model of the polluted River Trent was set up to assess the many benefits of a clean river, balance these benefits against the range of treatment methods available, optimize expenditures and keep the state of the river under review. The model has been successfully completed and is now in operation. (Ligon-Cornell)
W72-04546

A CONTINUOUS STORAGE MODEL WITH ALTERNATING RANDOM INPUT AND OUTPUT,
Indian Inst. of Tech., Madras. Dept. of Mathematics.
S. K. Srinivasan, and S. Ramani.
Journal of Hydrology, Vol 13, 1971, p 343-348. 6 ref.

Descriptors: *Stochastic processes, *Laplaces equation, *Input-Output analysis, *Storage, *Model studies, Probability, Reservoirs, Dams.

A stochastic model of a finite dam originally proposed by Miller with alternating input and output was considered. Corresponding to a release rate of unity, and the exponential nature of input and output, a renewal equation was set up for the probability frequency governing the water level during the first wet period. The resulting equation was solved by Laplace Transform Technique to obtain the probability density function governing the time to first emptiness. The probability density function governing the water level of the dam for subsequent emptiness was also deduced. (Ligon-Cornell)
W72-04547

COMPREHENSIVE ANALYSIS OF THE ATTLEBORO WATER SYSTEM USING COMPUTER TECHNIQUES,
Whitmas and Howard, Inc., Boston, Mass.
For primary bibliographic entry see Field 07C.
W72-04549

USING EXPERIMENTAL MODELS TO GUIDE DATA GATHERING,
General Electric Co., Santa Barbara, Calif. TEMPO.
For primary bibliographic entry see Field 07B.
W72-04578

CONJUNCTIVE USE OF SEA AND FRESH WATER RESOURCES: AN INTEGER PROGRAMMING APPROACH,
California Univ., Los Angeles. Dept. of Engineering Systems; and North American Rockwell Corp., Los Angeles, Calif.
F. Mobasheri, V. S. Budhraja, and F. E. Mack.
Water Resources Bulletin, Vol 7, No 4, p 823-830, August 1971. 1 fig, 11 ref.

Descriptors: *Linear programming, *Operations research, *Conjunctive use, *Economic feasibility, *Economic efficiency, *Reservoir storage, *Desalination, Water supply, Interest investment.
Identifiers: *Implicit enumeration techniques.

The feasibility of using an 0-1 integer linear programming technique for finding the optimum timing and sizing of water supply projects and the economic feasibility of certain desalination projects was determined. The objective was minimization of the present worth of the total system cost for meeting water demand through optimal use of surface storage reservoirs and desalination plants. Two models were examined using hypothetical data and operations research techniques. The algorithm used for solving these models is an integer programming routine using the implicit enumeration technique. This algorithm proved adequate in solving the problems formulated. Up to 200 decision variables and 113 constraint equations were programmed on the IBM 360/90 computer. From the computation results, desalination projects became economical in two cases: (1) when distance from reservoirs to demand zones becomes long, and (2) when a small demand has to be met and investment in surface projects is not justifiable (as in the case of short planning time horizons). Results show that development of desalination projects with ten years' active economic life brought substantial cost savings due to the postponement of investment in capital intensive surface reservoir projects which were far from the demand zone. (Haugh-Wisconsin)
W72-04700

SOME CONJUNCTIVE DESALTING STUDIES IN THE UNITED KINGDOM,
The Water Research Association, Marlow, (England); and University of Wales. Inst. of Science and Tech., Cardiff.
For primary bibliographic entry see Field 06D.
W72-04701

A MATHEMATICAL MODEL FOR EVALUATING THE POTENTIAL OF DESALTING,
Little (Arthur D.), Inc., Cambridge, Mass.; and Office of Saline Water, Washington, D.C.
T. W. Rothermel, M. S. Sachs, and F. O'Shaughnessy.
Water Resources Bulletin, Journal of the American Water Resources Association, Vol 7, No 4, p 867-877, August, 1971. 4 fig.

Descriptors: *Desalination, *Computer models, *Forecasting, *Water supply, *Comparative costs, Water demand, Brackish water, Flash distillation, Reverse osmosis, Long-tube vertical distillation, Electrodialysis.

The Office of Saline Water has recognized the need for a mathematical model to forecast the future potential of desalting. Future applications of desalting will evolve from the needs of (1) augmentation of conventional sources in critical water years, (2) arid parts of the Southwest, (3) water

quality improvements, (4) isolated communities, and (5) highly water-efficient agriculture. Desalting will increasingly be called upon to maintain the water supply-demand balance. Modeling is the best way to analyze desalting potential in view of the uncertainties involved in water supply due to political, legal and economic considerations. A dynamic simulation model has been developed by Arthur D. Little, Inc. to translate the determinants of water demand and supply into a forecast of desalting potential. The model projects needs for desalting in 20 hydrologic regions of the U. S. Current results indicate potential desalting capacities of 225 MGD in 1980, 2,250 MGD in 2000, and 7,000 MGD in 2020. Improvements in desalting economics will increase these potentials four to five times by the 2000-2020 period. Model inputs and results are continuing to be refined. Preliminary results indicate the models' ability to produce instinctive forecasts and to evaluate the role of desalting under various future conditions. (Haugh-Wisconsin)
W72-04703

6B. Evaluation Process

PROSPECTS FOR THE UTILIZATION OF THE UNIQUE WATER-POWER RESOURCES OF THE ANGARA AND ENISEI,
I. A. Terman.
Hydrotechnical Construction, No 1, p 1-7, Jan 1971. 7 p, 5 fig, 7 tab.

Descriptors: Foreign projects, Hydroelectric power, *Hydroelectric powerplants, *Hydroelectric resources, Reservoirs, Storage capacity, Powerplants, Production, Power, Power interchange, Power system operations, Planning, Economics, *River basin development.
Identifiers: *Enisei River (USSR), Siberia, Industrial development, USSR, River cascade systems.

The Enisei River is the most powerful river in the USSR and has the largest streamflow. The mean annual runoff is 623 km cubed; power potential is about 160 billion kwhr, and the water power resources of the entire basin are approximately 600 billion kwhr per year. The principal power-producing rivers of the Enisei Basin are the Enisei proper and its main tributaries, the Angara, and Nizhnyaya-Tunguska. On these rivers and 3 tributaries of the Enisei, 17 hydroelectric stations with a total capacity of more than 60 million kw and a production of 274 billion kwhr could be constructed. Stations with a total capacity of 22.4 million kw and a production of 95 billion kwhr have been or are being constructed. The large capacities of the hydroelectric stations in the Enisei Basin are possible because of favorable natural conditions: the large flows of the rivers and the geomorphological structure of the valleys, permitting high dam construction with large capacity reservoirs. Hydroelectric plants and their contribution to the industrial development of the region are discussed. (USBR)
W72-04111

THE POTENTIAL IMPACT OF ENVIRONMENTAL PROVISIONS UPON ELECTRIC UTILITY SYSTEMS COSTS,
Federal Power Commission, Washington, D.C.
For primary bibliographic entry see Field 06G.
W72-04113

RECENT TIDAL POWER INVESTIGATIONS IN THE BAY OF FUNDY,
Department of Energy, Mines and Resources, Ottawa (Ontario).
R. H. Clark.
Paper 2.2-55, 8th World Energy Conference, Bucharest, Romania, June-July 1971. 20 p, 5 fig, 1 tab, 10 ref.

Descriptors: *Tidal energy, *Tidal powerplants, Tidal hydraulics, Project planning, Project feasibility, *Investigations, Economics, Electric power production, Foreign projects, Model studies, Costs, Tube turbines, Dikes, Mathematical models, Bulb turbines.
Identifiers: *Site selection, Canada, *Bay of Fundy (Canada), Sluiceways.

In the Bay of Fundy on Canada's east coast, an area where the world's most powerful tides are experienced in bays and estuaries favorable to development of tidal power, there is an unharnessed annual power potential of many billions of kwhr. The Governments of Canada, New Brunswick, and Nova Scotia authorized joint studies of the technical and economic feasibility of developing this potential. The major considerations in formulation of the project are outlined. Of 3 sites considered, the Minas Basin site offers the most economical development of tidal power. The study considered the selection of the dike, powerhouse and sluiceway structures and the type and characteristics of the generating units. The installation and output optimization programs developed for the studies are reviewed, and the costs and economic merits of Fundy tidal power discussed. (USBR)
W72-04114

MARKETING, GENERATION AND TRANSMISSION ASPECTS OF A BAY OF FUNDY TIDAL POWER DEVELOPMENT,
National Energy Board, Ottawa (Ontario).
A. N. Karas.
Paper 2.2-35, 8th World Energy Conference Bucharest, Romania, June-July 1971. 20 p, 6 fig, 5 tab.

Descriptors: *Tidal energy, *Tidal powerplants, *Electric power production, Project feasibility, Transmission (Electrical), Project planning, Power marketing, Foreign projects, Peak power, Economics, Forecasting, Costs.
Identifiers: Canada, *Bay of Fundy (Canada), Interconnected systems, Load centers.

The Bay of Fundy on Canada's east coast, bounded by the Provinces of New Brunswick on the west and Nova Scotia on the east, experiences one of the world's largest tide ranges. This, coupled with favorable topography, provides a potential for power generation estimated in the thousands of megawatts. The Governments of Canada, New Brunswick, and Nova Scotia jointly agreed to conduct studies of the economic and technical feasibility of tidal power developments in the Bay of Fundy. Use of the electric power output of one of the large tidal power sites is discussed. The development is assumed to be a single basin, double effect plant. Studies show how such a large development, having an installed capacity of approximately 3500 mw, could be used to supply both local and export markets by means of an interconnecting transmission system. The generation characteristics of the tidal plant are discussed for 2 different modes of operation: one designed for peak power output, the other for energy production. The transmission facilities necessary to transmit tidal power to load centers and their costs, are discussed. (USBR)
W72-04115

ENERGY CONSUMPTION IN THE UNITED STATES: TRENDS AND PROBLEM AREAS,
National Economic Research Associates, Washington, D.C.
B. C. Netschert.
Paper 1.6-27, 8th World Energy Conference, Bucharest, Romania, June-July 1971. 20 p, 9 tab, 22 ref.

Descriptors: *Energy, Electric power, *Consumption, *Economics, Coal, Economic growth, Gross national product, Electric power industry, Fossil fuels, Industrial development, Hydroelectric power, Bibliographies, Environmental effects, Ecology, Population growth, United States, Natural gas, Pollution control, Thermal pollution, Forecasting.
Identifiers: Nuclear power.

Total energy consumption in the United States increased more rapidly during the 1960's than in any other decade. Per capita energy consumption continued to increase; growth in electricity consumption exceeded total energy consumption both absolutely and on a per capita basis. No significant change occurred over the decade in the relative proportion of total consumption by the consuming sectors, although, the electric utility industry's use of fossil fuels increased most rapidly. The household and commercial sector experienced the fastest growth in electricity consumption. There was no significant change in the pattern of inputs by primary energy source during the decade. Within the electricity generation sector, the proportion of hydro and coal in the total declined, while that of oil, gas, and nuclear increased, and the absolute quantities of all primary energy inputs to this sector increased. Continued pressure for environmental preservation will result in increased fuel and energy source costs, which could significantly affect the economic growth of the United States and its position in world commerce. (USBR)
W72-04116

DEVELOPMENT AND EVALUATION OF CITIZEN PARTICIPATION TECHNIQUES FOR INLAND LAKE AND SHORELAND MANAGEMENT,
Huron River Watershed Council, Ann Arbor, Mich.
J. K. Fulton.
Available from the National Technical Information Service as PB-206 689, $3.00 in paper copy, $0.95 in microfiche. Completion Report, December 1971. 43 p, 7 ref, 6 append. OWRR C-1874 (No 3174) (3).

Descriptors: *Lakes, *Lake shores, *Planning, Community development, Social aspects, Political aspects, Land use, Governments, Education, Michigan.
Identifiers: *Public participation, *Citizen involvement, Mailed contact-response, Two way communication, Property owners, *Huron River watershed (Mich).

Each property owner in five inland lake communities was invited to participate in a mailed contact-response program. One part involved 'response forms' from citizens that pertained to their opinions of the seriousness of problems and the importance of the benefits of living in the lake community. The other part consisted of factual information prepared by the staff of the project including 'Inland Lakes: Analysis and Action' and 'Inland Lakes: Reference Handbook'. A two way flow of information was established. 60% of all property owners accepted the initial invitation to participate. The problems and benefits varied from community to community. Problems ranked high in all communities were algae and aquatic weeds, mosquitoes, boating control, and high property taxes. Tests measuring the factual knowledge of citizens before and after exposure to the materials and methods indicated an increase occurred. This, combined with the relatively high participation rate and positive evaluation of the program by the participants, indicates that the technique is worthy of further testing and broader application as a method of resource management and community problem solving. Suggestions for program improvement are offered.
W72-04122

THE FLOOD PLAIN AS A RESIDENTIAL CHOICE-RESIDENT ATTITUDES AND PERCEPTIONS AND THEIR IMPLICATIONS TO FLOOD PLAIN MANAGEMENT POLICY,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
L. D. James, E. A. Laurent, and D. W. Hill.
Available from the National Technical Information Service as PB-206 424, $6.00 in paper copy, $0.95 in microfiche. Completion Report ERC-

0671, October 1971. 288 p, 3 fig, 42 tab, 4 append. OWRR Cc1786 (No 3167) (1).

Descriptors: *Flood plains, *Watershed management, *Attitudes, *Public behavior, *Decision making, *Land use, Hazards, Political constraints, Social values, Urbanization, Local governments, Institutional constraints, Water resources development, Flood plain zoning, Georgia, Water management (Applied).
Identifiers: *Peachtree Creek, *Atlanta (Geo), *Hazard perception.

Various levels of decision making affecting settlement in flood plains are analyzed from the viewpoints of individuals seeking a residential location, individuals engaged in land development and construction activity, and individuals charged with forming and implementing public flood control policy at various levels of government. A conceptual model is presented of factors influencing how individuals select a residential location, react to flood experiences, and pressure for government help. Information was collected and analyzed from a randomly selected, geographically stratified sample of 175 residents in the Peachtree Creek watershed in metropolitan Atlanta, Georgia. A number of implications with respect to flood plain management policy result from the study. When people are willing to endure frequent floods to enjoy other advantages of living in an area, a policy that automatically prohibits them from doing so needs to be critically reviewed. Basic differences between the type of people who knowingly risk flood hazards and the type who move onto flood plains unaware of the danger are outlined. These differences are discussed in the context of the differences in information that people in the two groups must be supplied to influence their location decisions. (See also W72-04125 thru W72-04127) (Conway-Georgia Tech)
W72-04124

REMEDIAL FLOOD PLAIN MANAGEMENT AS THE FOCUS FOR AN EXPERIMENT IN INTERDISCIPLINARY TEAM RESEARCH,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
L. D. James.
Available from the National Technical Information Service as PB-206 425, $3.00 in paper copy, $0.95 in microfiche. Completion Report ERC-0771, October 1971. 76 p, 3 tab. OWRR C-1786 (No 3167) (2).

Descriptors: *Flood plains, *Watershed management, *Research administration, *Methodology, *Research organization, Research and development, Water resources development, Educational institutions, Resources planning, Leadership, Georgia.
Identifiers: *Interdisciplinary research.

Interdisciplinary research conducted in a University setting is explored for ways of making it more effective. A research team comprised of people from six disciplines was organized to develop an approach for prescribing effective remedial and preventive flood plain management to alleviate the consequences of flooding on small urban waterways. After its research experience the team made 27 specific recommendations in order to help subsequent teams to be more successful. Key recommendations are that team members be recruited who are problem oriented but who have sufficient discipline focus to make meaningful contributions, that administration of a project not be tied to any specific discipline, that a core staff within the administrative unit be organized to keep the team moving, that viable research assignments be given each team member early in the total effort, that the duties of each team member be clearly defined, and that support from the university hierarchy and community be developed. The report is an evaluation of the team experience made by a non-participant in the initial interdisciplinary effort. (See also W72-04124) (Conway-Georgia Tech)
W72-04125

THE EFFECTS OF LAND USE CHANGE ON THE HYDROLOGY OF AN URBAN WATERSHED,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
J. R. Wallace.
Available from the National Technical Information Service as PB-206 426, $3.00 in paper copy, $0.95 in microfiche. Environmental Resources Center, Georgia Institute of Technology, Completion Report ERC-0871, October 1971. 66 p, 30 fig, 3 tab, 25 ref. OWRR C-1786 (No 3167) (3).

Descriptors: *Watershed management, *Urban watershed, *Urbanization, *Land use, *Urban land management, Flood plain management, Watershed management, Storm runoff, Rainfall, Peak flow, Flood control, Georgia.
Identifiers: *Peachtree Creek (Geo), *Nancy Creek (Geo), *Atlanta (Geo).

Historical changes in the pattern of land use and the effect of these changes on floods along Peachtree and Nancy Creeks, streams flowing through metropolitan Atlanta, Georgia, are analyzed and discussed. Land-use patterns in the watershed were determined at several points in time. Rainfall and runoff data were analyzed to determine the changes in hydrologic characteristics of the watershed effected by the changes in land use. Clearly, urbanization was found to affect the seasonal distribution of runoff. Overall, the study shows that urbanization of the watershed has increased storm runoff in the dry months, decreased base flow in the wet months and significantly increased the peak runoff from summer storms. The trend, if continued, may result in summer flood peaks as large as those which have occurred historically in the winter and spring months. (See also W72-04124) (Conway-Georgia Tech)
W72-04126

THE PEACHTREE CREEK WATERSHED AS A CASE HISTORY IN URBAN FLOOD PLAIN DEVELOPMENT,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
L. D. James, G. J. Kelnhofer, G. R. Elmore, and E. A. Laurent.
Available from the National Technical Information Service as PB-206 427, $3.00 in paper copy, $0.95 in microfiche. Completion Report ERC-0971, October 1971. 83 p, 3 fig, 1 tab. OWRR C-1786 (No 3167) (4).

Descriptors: *Flood plains, *Watershed management, *Urbanization, *Public behavior, *Attitudes, *Urban sociology, City planning, Political constraints, Social values, Decision making, Institutional constraints, Local governments, Flood plain zoning, Water resources development, Georgia.
Identifiers: *Peachtree Creek, *Atlanta (Geo).

Historical development in the Peachtree Creek flood plain and watershed, metropolitan Atlanta, Georgia, and the reactions of planning officials, changes in water quality and land values are analyzed to ascertain the implications of historical experience for improved flood plain management policy. The report presents (1) the historical sequences and causes and the role of governing officials in influencing development in the watershed from the time of earliest settlement, stressing flood plain development, (2) analysis of the relative values of undeveloped lots on and off the flood plain and discusses the extent to which observed differences are caused by expected flood damages as opposed to differences in other residential choice factors, and (3) changes in stream water quality associated with urbanization and assesses the magnitude of the problem created by storm water washing of urban areas even if no sanitary sewer effluent is discharged directly into the stream. Implications for formulating a more effective flood-plain policy are discussed and generally show that since management programs deal with people, multiple management approaches are needed to communicate effectively with each individual in an area. (See also W72-04124) (Conway-Georgia Tech)
W72-04127

OPTIMAL CAPITAL INVESTMENT IN THE EXPANSION OF AN EXISTING WATER RESOURCES SYSTEMS,
Texas Univ., Austin. Dept. of Chemical Engineering.
D. T. O'Laoghaire, and D. M. Himmelblau.
Water Resources Bulletin, Vol. 7, No. 6, p 1194-1209, December 1971. 5 fig, 1 tab, 14 ref.

Descriptors: *Optimization, *Optimum development plans, *Operations research, *Water resources, *Capital, *Capital costs, Cost analysis, Networks.
Identifiers: Branch and bound.

A new algorithm was described for finding the optimal expansion policy of a water resources system. Two commonly made premises were used: the system had (a) a deterministic hydrology and (b) a prespecified series of demands. The optimal expansion of a realistic water resources system to meet an increasing demand for municipal and industrial use, irrigation, energy and recreation over a planning horizon of T years was investigated. A number of possible dam sites were available for the further regulation of river (canal) flows in the basin and/or the regulation of imported waters into the basin. To maximize, over the set of alternative projects, the sum of discounted present value of net earnings subject to the demands and various institutional, physical and budgetary limits, an optimization problem (Problem I) was formed as an 0-1 mixed integer programming problem and was decomposed into the set of all feasible combinations (Problem II). The economic return was determined for each combination (Problem III). Problem II was solved by a branch and bound procedure which selected each feasible combination of dams while the optimal return for each such combination (Problem III) was found by a network analysis code. (Ligon-Cornell)
W72-04157

BIOPHYSICAL ENVIRONMENT AND HUMAN BEHAVIOR: LINKAGES AND FEEDBACK SYSTEMS,
Wisconsin Univ., Green Bay.
A. E. Bedrosian, J. E. Berry, J. W. Kolka, and T. W. Thompson.
Presented at Proceedings of the Symposium on Environmental Quality and Social Responsibility, Green Bay, Wisconsin, April 22, 1971. 8 p, 4 fig. OWRR B-046-WIS (3).

Descriptors: *Management, Economics, *Model studies, *Resource development, Political aspects, *Decision making, Planning, Social aspects, Environment.
Identifiers: *Interdisciplinary approach, *Integrated systems, Environmental quality.

The inadequacies of three models conceptualizing resource management decisions are reviewed. A fourth model incorporating environmental factors, economic activity, and legal-political forces is proposed. An 'unrestrained market' model is reviewed and dismissed for its grossly inadequate treatment of environmental quality. An agency control' model protecting environmental quality is explored, but judged deficient because of its simplistic treatment of legal-political constraints imposed by agencies on economic activity. A review of an 'economics versus environment' model shows improvement over the previous models. While it accounts for economic factors and environmental quality, it naively pits economic well being against environmental quality and fails to include linkages between environmental quality and economic health. It is faulted further by treatment of legal-political forces as rigid constraints, rather than integral parts of the system. Finally, an 'integrated' model is proposed to provide a

framework for formulating resource management strategies. Although it needs refinement, it remedies deficiencies of previous models. Treating legal and political forces as integral parts of the system, it links economic externalities with the natural environment. It integrates legal-political, economic, and environmental parameters in a system that produces a variety of management alternatives rather than single yes-no decisions. (Husbeck-Wisconsin)
W72-04291

THE LAKE NOQUEBAY PROJECT: REPORT ON THE FIRST PHASE IN A MULTI-DISCIPLINARY STUDY OF A RECREATIONAL LAKE,
Wisconsin Univ., Green Bay.
T. W. Thompson, A. J. Bedrosian, J. E. Berry, W. O. Bennett, and R. B. Ditton.
Report to the Marinette County Board of Supervisors, October 1970. 8 p. OWRR B-046-WIS (4).

Descriptors: *Watershed management, *Recreation, *Eutrophication, Wisconsin, Lakes, Water quality, Political aspects, Water law, Social aspects.
Identifiers: *Interdisciplinary study, *Survey report, Water milfoil, Swimmer's itch, Myriophyllum heterophyllum, Lake Noquebay, Marinette County (Wis).

The first phase in a study of Lake Noquebay designed to develop and demonstrate an action program in watershed management is described. The preliminary phase was designed to obtain background information on the Lake Noquebay watershed in order to isolate management problems and their causes. Areas considered were: (1) swimmer's itch; (2) a reported high degree of eutrophication; (3) the impact and importance of recreation in Marinette County and on Lake Noquebay; and (4) legal and political considerations of lake management in Marinette County. It was concluded that Lake Noquebay's waters were not eutrophic, judged by chemical and biological criteria. Swimmer's itch was not a problem during the summer of 1970, although a potential problem was posed by excessive growths of Myriophyllum heterophyllum in three areas of the lake. The tourist industry was faced with the problems of seasonality and marginal operations. Vitrually all types of water-based recreation took place on Lake Noquebay, contributing significantly to the County's economy. Legal-political considerations involved in assuring the health of the lake were found to be complicated due to the fragmentation of control among agencies. These problem areas will be considered in future studies in order to evaluate alternative management strategies. (Richards-Wisconsin)
W72-04293

AN APPROACH TO STUDIES OF EUTROPHICATION,
Wisconsin Univ., Green Bay.
A. E. Bedrosian, J. E. Berry, J. W. Kolka, and T. T. Thompson.
Paper presented at the Annual Meeting of the Wisconsin Academy of Sciences, Arts and Letters, Milwaukee, Wisconsin, May 1971. 5 p. OWRR B-046-WIS (2).

Descriptors: *Eutrophication, *Water quality, Recreation, Resources, Wisconsin, Lakes, *Watershed management.
Identifiers: *Interdisciplinary approach, Problem oriented research, Swimmer's itch, Water milfoil, Lake Noquebay, Marinette County (Wis).

The need for, and problems encountered in an interdisciplinary research project designed to develop and demonstrate an action program in watershed management on a recreational lake are discussed. Land sale activity, a proliferation of aquatic weeds and swimmer's itch provided evidence of accelerated eutrophication. The complexity of the problem demanded an interdisciplinary effort. To illustrate this point, the continued proliferation of water milfoil on Lake Noquebay would seriously reduce the recreational potential of the lakeand, as a result, a decline of property values and tourism would ensue. This in turn could spawn attempts to improve the lake in the form of legal restraints and chemical and/or mechanical weed control. The role of coordinator is vital to the development of integrated research. He must foster and maintain a spirit of cooperation and group effort, team scrutiny and refinement of design, effective interdisciplinary communication, and sampling techniques designed to satisfy the needs of all members. Beyond the immediate goals is the hope of creating an effective model which will extend the concept of an ecosystem beyond its current biological boundaries into the social environment. (Richards-Wisconsin)
W72-04294

AN ANALYSIS OF THE RELATIONSHIP BETWEEN STREAM WATER QUALITY AND REGIONAL INCOME GENERATED BY WATER-ORIENTED RECREATIONISTS,
Pennsylvania State Univ., University Park. Dept. of Economics.
For primary bibliographic entry see Field 05G.
W72-04351

NATIONWIDE STUDY OF HIGH MUNICIPAL WATER RATES,
Buttenheim Publishing Corp., Pittsfield, Mass.
For primary bibliographic entry see Field 03A.
W72-04355

ECONOMIC AND INSTITUTIONAL ANALYSIS OF WASTEWATER RECLAMATION AND REUSE PROJECTS,
Leeds, Hill and Jewett, Inc., San Francisco, Calif.
For primary bibliographic entry see Field 05D.
W72-04420

EVALUATION OF RECREATIONAL AND CULTURAL BENEFITS OF ESTUARINE USE IN AN URBAN SETTING,
Hofstra Univ., Hempstead, N.Y. Center for Business and Urban Research.
A. M. Levenson.
Available from the National Technical Information Service as PB-206 515, $3.00 in paper copy, $0.95 in microfiche. 1971. 121 p, 1 fig, 13 tab, 81 ref, 4 append. OWWR C-1818 (No. 3171) (1).

Descriptors: *Estuaries, *Estuarine environment, *Recreation, *Evaluation, *Boating, *Fishing, *Estimated benefits, Creel census, Marinas, Demand, Elasticity of demand, Expenditures, Marginal utility, Market value, Competitive prices, Monopoly, Welfare (Economics), New York.
Identifiers: *Hempstead, Nassau County, N.Y., Consumers' surplus, Differential land values, Value of recreation.

The value of the recreational uses of the Hempstead Estuary to the residents of the Town of Hempstead is derived. This estimate has two major components. The first is the consumers' surplus which accrues to those utilizing the estuary for fishing and boating, the major recreational activities in the estuary; this is derived from econometric demand equations for these activities. The second component of the value of annual services of the estuary is derived by calculating the differential in land values of land located on the estuary over nearby comparable parcels not on the estuary. This capital value is converted to an annual value-flow of services of the estuary by use of an appropriate discount rate. The various methods available for measuring values of the services of recreational sites are discussed. The land value-differential method, it is believed, has great merit in that the prices involved are determined in actual markets. A number of additional quantitative and qualitative measures of demand for use of the estuary, as well as an estimate of demand relative to capacity, are included.
W72-04421

MANAGEMENT OF OPTIMUM WATER QUALITY IN A STREAM,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 05B.
W72-04545

FOREIGN DEEPWATER PORT DEVELOPMENT (THREE VOLUMES),
Little (Arthur D.), Inc., Cambridge, Mass.
B. L. de Frondeville, J. L. Goodier, M. C. Huston, and B. M. Putnam.
Army Engineer Institute for Water Resources Report 71-11, December 1971, 800 p.

Descriptors: *Planning, *Water resources development, *Harbors, *Environmental effect, *Economics, Docks, Transportation, Channels, Cost sharing, Evaluation.
Identifiers: *Deep water ports, *Terminals, *Port development, *Planning techniques.

The economic advantages of large scale ocean carriers of oil and ores have developed considerable pressure for the development of a number of deep ports in the United States providing drafts in excess of 60 feet. This report is a study of selected foreign harbors (and off-shore loading and unloading facilities) where the experience was judged to be relevant to the U.S. situation. Specifically, the decision process leading to deep port development is examined, difficulties met and solved in construction and operation, and the relation between anticipations and experience are documented. Impacts on national economic policy, regional development objectives and environmental factors are discussed.
W72-04553

ATTITUDES, ASSESSMENTS, AND ACTION,
Oregon State Univ., Corvallis. School of Engineering.
For primary bibliographic entry see Field 05G.
W72-04563

INTERBASIN TRANSFERS: DO WE NEED THEM,
Colorado Univ., Boulder. Dept. of Economics.
For primary bibliographic entry see Field 03B.
W72-04692

POTENTIALS FOR REUSE OF WASTEWATER IN NORTH CENTRAL TEXAS,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials; and Camp, Dresser, McKee, Boston, Mass.
For primary bibliographic entry see Field 05D.
W72-04695

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ECONOMIC APPRAISAL OF IRRIGATION SYSTEMS FOR THE GREEN RIVER BASIN, WYOMING,
Wyoming Univ., Laramie. Div. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W72-04119

WHOLESALE COST ASPECTS OF WATER SUPPLY,
California State Dept. of Water Resources, Sacramento.
A. R. Golze.
Journal of the American Water Works Association, Vol 60, No 12, p 1367-1376, December 1968. 1 fig, 1 tab.

Descriptors: *Water supply, *Resource development, *Resources, *Costs, Financing.

With population expansion and increased per capita water consumption in recent years, the cost of water has become the key to continued development of many areas, particularly the semiarid west. The wholesale cost of water is defined as the cost of developing and bringing an adequate supply of potable water to an area of use. Excluded are the costs of local delivery systems, including regulating reservoirs, pumping plants, and customer service lines. The California Water Project came into existence because 75 percent of the state's precipitation occurs north of the latitude of San Francisco while 70 percent of water use is south of that latitude. The legislature provided funds for an investigation in 1948. In 1955 a report was submitted which showed The Feather River Project had engineering and financial feasibility. Construction began in May 1957. Cost of the project water is a combination of capital costs, including financing costs and operation and maintenance costs. Capital costs estimated on basis of preliminary plans used to support authorization for construction are revised and published annually as construction progresses. The state has executed contracts with 31 water service contractors for delivery of 4,230,000 acre-ft annually. Wholesale costs include a unit commodity charge, and a transportation charge which is essentially a charge for use of facilities. Funds for construction through 1971 have been derived from general obligation bonds. The water cost plan assures the recovery of all reimbursable expenditures and is sensitive to increasing costs, permitting the owner of a system to finance rising labor and other costs so that the system is properly maintained. (Bean-AWWA)
W72-04250

PROJECTED WASTEWATER TREATMENT COSTS IN THE ORGANIC CHEMICALS INDUSTRY (UPDATED).
Datagraphics, Inc., Pittsburgh, Pa.
For primary bibliographic entry see Field 05D.
W72-04297

A COMPILATION OF COST INFORMATION FOR CONVENTIONAL AND ADVANCED WASTEWATER TREATMENT PLANTS AND PROCESSES,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Water Research Lab.
For primary bibliographic entry see Field 05D.
W72-04298

AN ANALYSIS OF THE RELATIONSHIP BETWEEN STREAM WATER QUALITY AND REGIONAL INCOME GENERATED BY WATER-ORIENTED RECREATIONISTS,
Pennsylvania State Univ., University Park. Dept. of Economics.
For primary bibliographic entry see Field 05G.
W72-04351

ECONOMIC AND INSTITUTIONAL ANALYSIS OF WASTEWATER RECLAMATION AND REUSE PROJECTS,
Leeds, Hill and Jewett, Inc., San Francisco, Calif.
For primary bibliographic entry see Field 05D.
W72-04420

WATER DIVERSIONS TO THE NORTH AMERICAN PRAIRIES,
Texas Tech Univ., Lubbock. Dept. of Civil Engineering.
For primary bibliographic entry see Field 03B.
W72-04693

6D. Water Demand

A NEW METHOD FOR FORECASTING HOURLY DEMANDS,
Hydro-Electric Power Commission of Ontario, Toronto.
L. Higgins, and S. Brubacher.
Paper 4.1-92, 8th World Energy Conference, Bucharest, Romania, June-July, 1971. 16 p, 3 fig, 6 ref.

Descriptors: *Forecasting, *Electric power, *Electric power demand, Electric power production, Temperature, Wind (Meteorology), Weather, Planning, Operation and maintenance, Foreign research, Scheduling, Computer programming, Analysis, Long-term planning, Short-term planning, Time series analysis, Multiple regression.
Identifiers: Canada, Analytical method, Interconnected systems.

Since electric power cannot be stored, but must be produced as required, planning capacity and scheduling production, maintenance, and operation of interconnections require a knowledge of hourly demand variations and a means of forecasting short- and long-term variations. Short-term demand is sensitive to illumination, temperature and wind; sensitivity may change for longer term demand. Apart from weather effects, the hourly pattern of demand is subject to change with changing habits of the population, appliance saturations, and load mix. The load pattern in any year is also subject to seasonal change. A new technique for analyzing and projecting the hourly pattern of demand based upon an extension of seasonal adjustment is presented. The unit of time chosen is 1 hr, and the periodicity used is 1 wk or 168 hr. Each step of the analysis and formulas for computer solution are given. Special treatment is required for the 2 types of holidays: those falling on the same day of the week each year, and those falling on a fixed date (Christmas), which may be any day of the week. (USBR)
W72-04109

POTENTIAL TECHNOLOGICAL ADVANCES AND THEIR IMPACT ON ANTICIPATED WATER REQUIREMENTS.
National Academy of Sciences, Washington, D.C. Committee on Technologies and Water.

Available from the National Technical Information Service as PB-204 053, $3.00 in paper copy, $0.95 in microfiche. National Water Commission Report No NWC-EES-71-015, June 1971. 249 p, 258 ref. NWC 70-002.

Descriptors: *Forecasting, *Water supply, *Water demand, Technical feasibility, Water utilization, Electric power production, Cooling water, Irrigation water, Municipal wastes, Disposal, Water yield improvement, Future planning (Projected), Water requirements, Technology, Priorities, Programs.
Identifiers: Technological impacts.

Potential technological advances and their effect on water supply and demand in the future are evaluated. These advances are considered in terms of possibilities, rather than as predictions of events most likely to happen. It presents a directory of concepts to increase or decrease future water demand, to increase usable supplies, and to extend usefulness of impure water. A chronological estimation of the likelihood and operational utility of new technologies is included. Consideration is given to 6 non-technical concepts which may have an impact on the direction of future technological effort. In four scenarios of possible futures, technological concepts are applied to food production, electric power generation, urban water supply and municipal waste disposal, with identification of political, social and economic factors. The report indicates research priorities and ways in which technological change should be given greater emphasis in water planning. A bibliography of related works is included. (NWC)
W72-04215

AN ECONOMIC MODEL FOR A POLLUTED RIVER SYSTEM,
Water Resources Board, Reading (England).
For primary bibliographic entry see Field 05G.
W72-04256

MULTISTRUCTURED MUNICIPAL WATER DEMAND MODEL,
Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science.
For primary bibliographic entry see Field 06A.
W72-04257

EFFECTS OF RESERVOIR OPERATING POLICY ON RECREATION BENEFITS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
J. M. Morgan, and P. H. King.
Water Resources Bulletin, Vol 7, No 4, p 765-773, August 1971. 4 fig, 4 tab, 15 ref. OWRR B-009-VA (1).

Descriptors: *Intangible benefits, *Water level fluctuations, *Drawdown, *Reservoir operation, *Recreation, Multiple-purpose reservoirs, Kentucky.
Identifiers: *Lake Cumberland (Kentucky).

Since recreation has become increasingly important in multiple-purpose water resource development, it is necessary to include an explicit recreation benefit-loss function in the development of a model to determine optimum reservoir operating policy. Fluctuation in water level is the most controversial factor affecting recreation benefits. This study quantifies the effect of reservoir drawdown on recreation benefits. Data relating reservoir attendance and drawdown over a nine-year period, 1958-66, for 27 reservoirs was studied. Using linear regression it was found that statistically significant relationships between year and attendance exist for about one-half of the reservoirs. Fifteen showed constant or declining attendance due to crowding, distance from population concentrations, drawdown and competition of new projects. Eleven of these reached maximum utilization, with reservoirs located near new projects showing this effect most markedly. To increase the accuracy of estimating attendance (benefits), other variables were included and competition excluded in a multiple linear regression analysis. No significant relationship was shown to exist between reservoir level fluctuations (or any related parameter) and recreation attendance. (Haugh-Wisconsin)
W72-04697

CONJUNCTIVE USE OF SEA AND FRESH WATER RESOURCES: AN INTEGER PROGRAMMING APPROACH,
California Univ., Los Angeles. Dept. of Engineering Systems; and North American Rockwell Corp., Los Angeles, Calif.
For primary bibliographic entry see Field 06A.
W72-04700

SOME CONJUNCTIVE DESALTING STUDIES IN THE UNITED KINGDOM,
The Water Research Association, Marlow, (England); and University of Wales. Inst. of Science and Tech., Cardiff.
P. A. Mawer, J. P. J. O'Kane, J. D. P. Sherrif, T. Wyatt, and J. D. Barrett.
Water Resources Bulletin, Vol 7, No 4, p 831-843, August 1971. 10 fig, 5 tab, 7 ref.

Descriptors: *Conjunctive use, *Optimum development plans, *Dynamic programming, Reliability, Economic efficiency, Markov processes.
Identifiers: *Barcelona (Spain), *Hill-climbing technique, *Desalting plant load factor, *Operating rule procedures, Reservoir level, New York, Imported waters.

Operating rule procedures have been developed for the optimal conjunctive use of desalination and conventional water resource systems, the objective being to minimize the cost of meeting a given water demand at a specific degree of reliability. Operating rules consist of a set of critical reservoir levels which are used to determine the expected

plant load factor and check on system reliability. Two methods explored for the optimization of critical levels are hill-climbing and value iteration dynamic programming, both of which confirm (through tests on synthetic data sequences) the good stability of expected load factors which are reproduced with low variances. In the Barcelona area of Spain where conjunctive desalination was studied as a means of delaying water importations, the hill-climbing method showed a marginal superiority. The operating rule optimizer was of the hill-climber type. A dynamic programming optimization of the investment schedule was undertaken to determine the optimum period of use for desalination as well as a plant construction schedule. Benefits from interim use of conjunctive desalting were large. The operating rules described here can be applied to the optimization of surface groundwater systems. (Haugh-Wisconsin)
W72-04701

A MATHEMATICAL MODEL FOR EVALUATING THE POTENTIAL OF DESALTING,
Little (Arthur D.), Inc., Cambridge, Mass.; and Office of Saline Water, Washington, D.C.
For primary bibliographic entry see Field 06A.
W72-04703

6E. Water Law and Institutions

ANNUAL REPORT OF ACTIVITIES DURING FISCAL YEAR 1971.
Maine Univ., Bangor. Water Resources Center.
For primary bibliographic entry see Field 05C.
W72-04261

WORKSHOP-CONFERENCE ON RECLAMATION OF MAINE'S DYING LAKES.
Maine Univ., Bangor.
For primary bibliographic entry see Field 05C.
W72-04279

CRITERIA FOR DETERMINING ECONOMIC PRIORITIES IN AWARDING SEWAGE FACILITY CONSTRUCTION GRANTS,
Pennsylvania State Univ., University Park. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 05G.
W72-04286

LAW AND THE ECOSYSTEM: DOES NATURE HAVE A LEGAL PERSONALITY,
Wisconsin Univ., Green Bay.
A. E. Bedrosian, J. E. Berry, J. W. Kolka, and T. W. Thompson.
Presented at Proceedings of the Symposium on Environmental Quality and Social Responsibility, Green Bay, Wisconsin, April 22, 1971. 6 p, 4 ref. OWRR B-046-WIS (5).

Descriptors: *Political aspects, Governments, Ecosystem, Interstate, *Water law, *Lake Erie, Great Lakes Region, Judicial decisions, Polluting abatement, Social aspects.
Identifiers: Supreme Court, Interdisciplinary approach.

The Supreme Court of the United States refuses original jurisdiction in a multi-state case of mercury pollution in Lake Erie. Legal conceptions of the physical universe tend to be anthropocentric. A human centered universe inhibits recognition of humans as complex organisms inhabiting an ecosystem. Meaningful solutions to ecological problems will ultimately compel legal recognition of ecosystems and human activities within these systems.
W72-04290

THE FORMATION AND DEVELOPMENT OF A COUNTY SEWERAGE AGENCY,
Unified Sewerage Agency of Washington County, Hillsboro, Oreg.
For primary bibliographic entry see Field 05G.
W72-04321

LEGAL ASPECTS OF OWNERSHIP AND USE OF ESTUARINE AREAS IN GEORGIA AND SOUTH CAROLINA,
Georgia Univ., Athens. Inst. of Government.
C. Leavell.
Available from the National Technical Information Service as PB-206 694, $3.00 in paper copy, $0.95 in microfiche. Institute of Government, University of Georgia, 1971. 111 p, 357 ref. OWRR B-030-GA (1).

Descriptors: *Legal aspects, *Estuaries, *Water law, Boundaries, Public rights, Riparian rights, Prescriptive rights, Submerged lands act, Legislation, Tidal waters, Southeast, Georgia, South Carolina.

Legal doctrines governing the ownership and use of estuarine areas in Georgia and South Carolina are identified and analyzed. The law of each state is analyzed, first, from the standpoint of 'ownership' of land in each of the following categories or classifications: the foreshore of estuarine areas; beds of tidal waterways and beds of the marginal sea less than three geographical miles from a state 'coast line'; and secondly, as to the rights in waters in estuarine areas utilizing the following categories: foreshore waters, navigable and non-navigable streams, and marginal seawaters within the three geographical mile limit. Special legal doctrines of particular significance to estuaries such as accretion, erosion, adverse possession, and dedication are considered separately. Controls by state regulation in the respective states are dealt with briefly. Generally, it was found in Georgia that regulatory control of the estuarine area consists primarily of permit regulation of the coastal marshlands. There is no 'multi-purpose' estuarine area or coastal zone management legislation which would focus on planning for both conservation and development of the area. In South Carolina at present, there is no general regulatory legislation providing for the protection and management of estuarine areas. There are, however, a number of statutes which directly or potentially affect estuarine areas. At this time statutory authority for estuarine areas is fragmented and scattered among a number of agencies with differing, and often conflicting powers and objectives.
W72-04348

ECONOMIC AND INSTITUTIONAL ANALYSIS OF WASTEWATER RECLAMATION AND REUSE PROJECTS,
Leeds, Hill and Jewett, Inc., San Francisco, Calif.
For primary bibliographic entry see Field 05D.
W72-04420

AGRICULTURE:S RESPONSIBILITIES IN A CLEAN ENVIRONMENT,
New York State Dept. of Environmental Conservation, Albany.
For primary bibliographic entry see Field 05G.
W72-04605

INTEGRATION OF COMPONENTS INTO A SYSTEM,
Cornell Univ., Ithaca, N.Y. Dept. of Poultry Science.
R. J. Young.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management February 10-12, 1971, Syracuse, New York, p 142-149. 7 fig.

Descriptors: *Farm wastes, *Water quality act, Landfills, Farm lagoons, Incineration, Treatment, Oxidation lagoons, Regulations, Fertilizers, Nutrients, *Standards, *Institutional constraints.
Identifiers: *Air quality standards, Land spreading, Composting, Local regulations, State regulations.

In analyzing the various methods for handling animal wastes, each method must be considered with the individual management application in mind. It is also apparent that there are a number of constraints and alternatives which must be taken into consideration before a given system is adopted. These constraints are the local, state and federal regulations in regard to air and water quality standards, public health laws and environmental protection regulations. The long-range consequences of any action taken must be evaluated so that the solution of one waste disposal problem does not create another. High priority should be given to the incorporation of animal wastes into a cropping system to get the maximum uptake of nutrients. If possible, recycling and reuse of animal wastes should be part of the management system. The primary consideration is to be given to source control. Examination of all of the feasible methods that meet the conditions of state and federal regulations may show that the cost of waste disposal for a particular product is far too costly, and therefore a more economical procedure may be a change in management practice which would prevent or significantly reduce the amount of waste materials generated. (See also W72-04604) (Bundy-Iowa State)
W72-04625

ADVISORY GROUPS FOR ENVIRONMENTAL PROTECTION AND AGRICULTURAL COOPERATION,
Wisconsin Univ., Madison. Dept of Dairy Science.
J. W. Crowley.
In: Agricultural Wastes: Principles and Guidelines for Practical Solutions, Cornell University Conference on Agricultural Waste Management, February 10-12, 1971, Syracuse, New York, p 150-156.

Descriptors: *Farm waste, Regulations, Waste disposal, Cattle, Public health, Safety, Legal aspects.

The idea of an advisory group can be illustrated by experiences with advisory groups in other general problems. In dairy production, the involvement of various production groups, marketing groups, and quality control agencies has a long history. There have been occasions when one group formulated ideas without due consideration of the needs or responsibilities of the other group. Also, there have been many questions or problems that require immediate practical solutions but only judgment or guesses are available. When this occurs, the best judgment or guess results when all groups involved discuss, debate, and finally compromise on the practical solution. The primary objective of the advisory committee is to develop guidelines. These must be acceptable to all groups that have enforcement responsibilities. The suggestions in the guidelines must also be practical and realistic; however, they cannot assure compliance with regulations. The advisory committee is essentially an Ad Hoc group; however, permanent structure is needed so that a representative can request and get action for revision. The guidelines are essentially an educational publication and should be continually up-dated as needs arise. (See also W72-04604) (Bundy-Iowa State)
W72-04626

CONSEQUENCES OF MERCURY POLLUTION AND LEGAL REMEDIES,
Vanderbilt Univ., Nashville, Tenn. School of Law.
For primary bibliographic entry see Field 05G.
W72-04637

6F. Nonstructural Alternatives

THE FLOOD PLAIN AS A RESIDENTIAL CHOICE-RESIDENT ATTITUDES AND PERCEPTIONS AND THEIR IMPLICATIONS TO FLOOD PLAIN MANAGEMENT POLICY,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
For primary bibliographic entry see Field 06B.

W72-04124

REMEDIAL FLOOD PLAIN MANAGEMENT AS THE FOCUS FOR AN EXPERIMENT IN INTERDISCIPLINARY TEAM RESEARCH,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
For primary bibliographic entry see Field 06B.
W72-04125

THE PEACHTREE CREEK WATERSHED AS A CASE HISTORY IN URBAN FLOOD PLAIN DEVELOPMENT,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
For primary bibliographic entry see Field 06B.
W72-04127

WORKSHOP-CONFERENCE ON RECLAMATION OF MAINE'S DYING LAKES.
Maine Univ., Bangor.
For primary bibliographic entry see Field 05C.
W72-04279

6G. Ecologic Impact of Water Development

ECOLOGICAL EFFECTS OF A THERMAL POWER PLANT ON THE AQUATIC HABITAT OF A LARGE FRESH WATER LAKE IN THE UNITED STATES,
Detroit Edison Co., Mich.; and Michigan State Univ., East Lansing.
For primary bibliographic entry see Field 05C.
W72-04110

THE POTENTIAL IMPACT OF ENVIRONMENTAL PROVISIONS UPON ELECTRIC UTILITY SYSTEMS COSTS,
Federal Power Commission, Washington, D.C.
J. N. Nassikas.
Paper 2.1-19, 8th World Energy Conference, Bucharest, Romania, June-July 1971. 20 p, 7 tab.

Descriptors: *Electric utilities, Electric power production, Electric power, Aesthetics, *Environmental effects, Economics, Electrical design, Expansion, Underground transmission lines, Underground cables, Growth rates, Landscaping, Transmission lines, Architecture, Air pollution, Waste heat, Cooling water, Land use, Costs.
Identifiers: Waste heat sources, Lane-use practices, Site selection.

During the next 2 decades, electric utilities in the United States must expand their facilities extensively to provide the electric energy requirements for the nation's economy. By 1990, generating capacity and electric power production are expected to quadruple those of 1970. Environmental concerns must be taken into account in future development of the power industry; environmental accommodation will result in increased costs. These added costs need not be exhorbitant. Aesthetic improvements can be made at modest increases in cost by placing distribution facilities underground, by selecting more pleasing tower designs for transmission lines, and by choosing carefully planned routes. Underground transmission, although aesthetically desirable, is not yet economically or technically feasible for general use. Powerplant appearance can be improved by proper architectural design and appropriate landscaping of sites. (USBR)
W72-04113

FOREIGN DEEPWATER PORT DEVELOPMENT (THREE VOLUMES),
Little (Arthur D.), Inc., Cambridge, Mass.
For primary bibliographic entry see Field 06B.
W72-04553

TECHNOLOGY AND MANAGEMENT OF THE ENVIRONMENT,
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 05G.
W72-04562

07. RESOURCES DATA

7A. Network Design

A TOPOLOGICALLY OPTIMUM WATER-SAMPLING PLAN FOR RIVERS AND STREAMS,
South Carolina Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 04A.
W72-04162

COMPREHENSIVE ANALYSIS OF THE ATTLEBORO WATER SYSTEM USING COMPUTER TECHNIQUES,
Whitmas and Howard, Inc., Boston, Mass.
For primary bibliographic entry see Field 07C.
W72-04549

PROPOSED BASE-LINE SAMPLING PROGRAM,
For primary bibliographic entry see Field 05A.
W72-04665

IDENTIFICATION OF GLOBALLY DISTRIBUTED WASTES IN THE MARINE ENVIRONMENT,
For primary bibliographic entry see Field 05A.
W72-04666

7B. Data Acquisition

REMOTE SENSING OF SOUTHERN CALIFORNIA OIL POLLUTION EXPERIMENT.
Coast Guard, Washington, D.C. Pollution Control Branch.
For primary bibliographic entry see Field 05A.
W72-04165

MICROWAVE RADIOMETRIC OBSERVATIONS OF CONTROLLED OIL SPILLS,
Aerojet-General, El Monte, Calif.
For primary bibliographic entry see Field 05A.
W72-04166

RESULTS OF AIRBORNE MEASUREMENTS TO DETECT OIL SPILLS BY REFLECTED SUNLIGHT,
National Aeronautics and Space Administration, Moffett Field, Calif. Ames Research Center.
For primary bibliographic entry see Field 05A.
W72-04167

RADAR DETECTION AND MONITORING OF OIL SLICKS,
Naval Research Lab., Washington, D.C.
For primary bibliographic entry see Field 05A.
W72-04168

ANALYSIS OF MULTISPECTRAL DATA FROM THE CALIFORNIA OIL EXPERIMENT OF OCTOBER 1970,
Michigan Univ., Ann Arbor. Willow Run Labs.
For primary bibliographic entry see Field 05A.
W72-04169

A NEW METHOD FOR MEASURING THE DISSIPATION RATE OF TURBULENCE IN CLOUDS AND PRECIPITATION USING A CONVENTIONAL RADAR,
For primary bibliographic entry see Field 02B.
W72-04174

PRECISION OF SAMPLING BY DOTS FOR PROPORTIONS OF LAND USE CLASSES,
North Carolina State Univ., Raleigh. Inst. of Statistics.
A. J. Faber.
Mimeograph Series No. 773. 153 p, 26 fig, 17 tab, 41 ref. OWRR B-010-NC (1).

Descriptors: *Statistical methods, *Correlation analysis, *Sampling, *Aerial photography, *Land use, Statistics, Watershed management, Land classification.

The precision of sampling for land use proportions from aerial photographs was evaluated for the Lake Michie watershed, the primary water source for Durham, North Carolina. Recommendations are based on the correlogram of the distribution of land use classes over the whole watershed. To sample for proportions of forest and cultivated land, the systematic sampling design is theoretically best. A systematic sample of single elements over the whole area to estimate proportions of land use classes under classification is recommended. This study was limited to correlograms of the distribution of forest. One photograph is not large enough to infer the characteristics of the entire process responsible for the occurrence of forest. Negative correlations are often found for small areas, but in a large area, negative correlations are weaker due to irregularities in the land use pattern. The process is not stationary from photograph to photograph. An assumption of isotropy for the Lake Michie watershed was in general reasonable. The use of a correlation estimate computed from pairs of points taken once, is recommended for investigating isotropic conditions in sample data collected by means of lattices. The variance of systematic sampling for proportions of land use from lattices on individual photographs will show irregularities if the elements of the whole lattice form a finite population of constants. For areas larger than a single photograph, variations in the decrease of the variance of systematic sampling with increasing sample size will be less. In the case of expected variances the fitted correlation function smoothes out the effect of quasi-periodicity. In the case of the Lake Michie watershed a positive, convex, rapidly to zero decreasing correlation function of the distribution of any land use class was assumed, and the precision of random and systematic sampling schemes was about equal. The evaluation of the precision of systematic sampling by simple random sampling formulas is on the average justified provided lattices are not very dense.
W72-04289

A COLORIMETRIC METHOD FOR THE DETERMINATION OF TRACE COPPER CONCENTRATIONS IN WATER,
Auburn Univ., Ala. Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W72-04325

A COMPACT POTENTIOMETRIC SENSOR OF NOVEL DESIGN. IN SITU DETERMINATION OF PH, PS (2-), AND EH,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
For primary bibliographic entry see Field 02K.
W72-04332

ESTIMATION OF THE EFFECT OF SURFACE RUNOFF ON READINGS OF SOIL EVAPORATION PANS AND LYSIMETERS (OTSENKA VLIYANIYA POVERKHNOSTNOGO STOKA NA POKAZANIYA POCHVENNYKH ISPARITELEY I LIZIMETROV),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02D.
W72-04357

METHOD OF RATING FLOW IN A STORM SEWER,
Geological Survey, Mineola, N. Y.
G. E. Seaburn.
Available from GPO, Washington, DC 20402 Price - $2.50. Geological Survey Research 1971, Chapter D, Professional Paper 750-D, p D219-D223, 1971. 5 fig, 3 ref.

Descriptors: *Discharge (Water), *Storm drains, *Cities, *Discharge measurement, Stage-discharge relations, Current meters, Critical flow, Venturi flumes, Flumes, Weirs, Flowmeters, Pit recharge, New York, Urbanization.
Identifiers: *Urban hydrology, Long Island (NY).

Accurate flow measurements in storm-sewer systems are required for many hydrologic studies and are generally difficult to obtain. One approach is to use a theoretical rating curve between stage and discharge developed by using the critical-flow relationship and the Bernoulli equation. To verify this curve, a rating curve for the local storm-sewer system was developed from flow measurements of water supplied by nearby fire hydrants. Three methods were used to measure flow: volumetric, current-meter, and critical-flow measurements. The field-determined rating curve and the theoretical rating curve are nearly identical for the range of the field tests. Instantaneous discharges exceeding the field rating curve were evaluated by using the extension of the theoretical rating curve. (Knapp-USGS)
W72-04363

RESISTIVITY AND NEUTRON LOGGING IN SILURIAN DOLOMITE OF NORTHWEST OHIO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W72-04369

THE PHYSICS OF FINE-PARTICLE MOVEMENT THROUGH PERMEABLE AQUIFERS,
Westinghouse Electric Corp., Pittsburgh, Pa.
For primary bibliographic entry see Field 05B.
W72-04537

USING EXPERIMENTAL MODELS TO GUIDE DATA GATHERING,
General Electric Co., Santa Barbara, Calif. TEMPO.
C. F. Meyer.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY10, Paper 8449, p 1681-1697, October 1971. 4 fig, 1 tab, 28 ref, append. OWRR C-1339 (No. 1971) (4).

Descriptors: *Mathematical models, *Data collections, *Simulation analysis, Probability, Groundwater movement, Monte Carlo method, Linear programming, Parametric hydrology, Water management (Applied), Hydrologic data.
Identifiers: Data analysis.

In constructing a plausible mathematical model of a groundwater basin, the use of a series of experimental models may be the minimal-cost approach to guiding data-gathering programs while simultaneously developing a plausible model to be used for predicting the consequences of management decisions. The basis for experimentation is a sensitivity analysis, for which triangular probability distributions are suggested as appropriate methods for perturbing known values of parameters into erroneous values. The worth of improving the accuracy of measurements or estimates can be evaluated empirically by use of these techniques. Automated techniques for deducing basin parameters from histories of water level were developed but were not fully successful. Use of linear programming shows some promise but requires further development before being routinely applicable. (See also W71-01194) (Knapp-USGS)
W72-04578

EXCAVATION SEISMOLOGY,
Honeywell, Inc., St. Paul, Minn. Systems and Research Center.
For primary bibliographic entry see Field 08H.
W72-04586

OXYGEN CONSUMPTION BY THE SEABED. IV. SHIPBOARD AND LABORABORY EXPERIMENTS,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 05B.
W72-04635

LASER-VELOCITY METER,
Lund Univ. (Sweden). Div. of Hydraulics.
L. Jonsson.
Journal of Hydraulic Research, Vol 9, No 4, p 493-504, 1971. 6 fig, 8 ref.

Descriptors: *Current meters, *Velocity, *Instrumentation, Pipe flow, Light, Optical properties.
Identifiers: *Lasers, *Doppler effect.

A new principle for water velocity measurements in the laboratory is based on monochromatic laser light and uses the Doppler effect when the laser beam is scattered by moving particles in the streamflow. The streamflow must take place in transparent conduits. The streamflow is not disturbed. Mean velocity can be determined with spectral analysis. (Knapp-USGS)
W72-04671

AN AUTOMATIC DIGITAL WATER LEVEL FOLLOWER,
Centre National de la Recherce Scientifque, Toulouse (France). Hydrulic Lab.
J. Piquemal, G. Laville, H. Pourciel, and J. Majos.
Journal of Hydraulic Research, Vol 9, No 4, p 555-563, 1971. 8 fig, 1 ref.

Descriptors: *Water levels, *Stream gages, *Telemetry, *Automation, *Instrumentation, Water level fluctuations, Water measurement.
Identifiers: *Water level recorders.

A new digital system automatically follows very slow water level variations. When operated manually, it can achieve an accuracy of about plus or minus 0.1 mm, which is ample for most practical applications. Its accuracy when operating automatically is of the order of a few tenths of a millimeter. (Knapp-USGS)
W72-04673

7C. Evaluation, Processing and Publication

STUDIES IN THE APPLICATION OF DIGITAL SIMULATION TO URBAN HYDROLOGY,
Hydrocomp International, Palo Alto, Calif.
For primary bibliographic entry see Field 02A.
W72-04123

ANALYSIS OF BLENDS OF MIXTURES USING MULTIVARIATE STATISTICS,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 05A.
W72-04132

A COMPUTER-PROCESSED SEMI-AUTOMATIC TITRATOR FOR HIGH-PRECISION ANALYSIS,
Goteborg Univ. (Sweden). Dept. of Analytical Chemistry.
For primary bibliographic entry see Field 02K.
W72-04152

WATER TEMPERATURES OF CALIFORNIA STREAMS, COLORADO DESERT SUBREGION,
Geological Survey, Menlo Park, Calif.
J. C. Blodgett.
Geological Survey Open-file Report, 1971. 30 p, 4 fig, 1 tab, 24 ref.

Descriptors: *Water temperature, *Streams, *Hydrologic data, *Data collections, *California, Regional analysis, Colorado River, Average, Fluctuation.
Identifiers: *Colorado Desert Subregion (Calif).

This summary of water-temperature records collected through September 1968 in the Colorado Desert Subregion of California includes data for 35 stream sites. Water temperatures, in degrees Celsius, are summarized by months, years, and for the period of record. A description is included to identify each station where data were collected. A tolerance interval analysis indicates that 99% of the point water-temperature observations, determined either with thermograph probes or handheld thermometers, should be within 0.6 deg C of the mean water temperature of the 95% confidence level. The probable total error ranges from 0.8 deg C for periodic data to 1.4 deg C for thermograph data. (Woodard-USGS)
W72-04202

APPLICATION OF BOREHOLE GEOPHYSICS TO WATER-RESOURCES INVESTIGATIONS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04B.
W72-04203

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE NUECES RIVER BASIN, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02K.
W72-04204

CHEMICAL ANALYSES OF GROUND WATER IN THE POWDER RIVER BASIN AND ADJACENT AREAS, NORTHEASTERN WYOMING,
Geological Survey, Cheyenne, Wyo. Water Resources Div.
For primary bibliographic entry see Field 02K.
W72-04205

APPLICATION OF ANALOG COMPUTER FOR STREAMFLOW SYNTHESIS-PHASE I,
Nevada Univ., Reno. Center for Water Resources Research.
For primary bibliographic entry see Field 04A.
W72-04207

FLOOD OF JANUARY 1969 NEAR CARPINTERIA, CALIFORNIA,
Geological Survey, Washington, D.C.
F. W. Fenzel, and M. Price.
Available from US Geol Survey, Washington, D C 20242 - Price $1.00. Geological Survey Hydrologic Investigations Atlas HA-422, 1 sheet, 1971. Text, 4 fig, 1 map, 2 ref.

Descriptors: *Floods, *Flood damage, *Streamflow, *Peak discharge, *California, Runoff, Stream gages, Flood control, Small watersheds, Historic flood, Flood forecasting.
Identifiers: *Carpinteria (Calif), Hydrologic atlas, Intermediate regional flood.

Disastrous floods occurred in Carpinteria, California and vicinity on January 25, 1969, as a result of heavy storms. The approximate areas inundated by overflows from Arroyo Paredon and from Santa Monica, Franklin, Carpinteria, Gobernador and Rincon Creeks are described in this atlas. The inundation map and graphs show the extent and frequency of the floods. The Carpinteria area is located along the narrow coastal plain between the Santa Ynez Mountains and the Santa Barbara Channel, 10 miles east of Santa Barbara. The basins are small and the channels are short and steep. Carpinteria Creek, drainage area, 14.9 square miles, is the largest basin in the area

covered by the atlas. Flood damage was estimated at nearly $4 million. The crest stage of 14.9 feet on January 25, 1969, in Carpinteria Creek at the gaging station near Carpinteria was 5.1 feet higher than the previous maximum recorded stage which occurred on January 15, 1952, and the peak discharge of 4,560 cubic feet per second was 1.7 times that of December 6, 1966, the previous maximum in the period of record 1941-69. (Woodard-USGS)
W72-04329

GEOHYDROLOGY OF THE PICEANCE CREEK STRUCTURAL BASIN BETWEEN THE WHITE AND COLORADO RIVERS, NORTHWESTERN COLORADO,
Geological Survey, Washington, D.C.
D. L. Coffin, F. A. Welder, and R. K. Glanzman.
Available from US Geol Survey, Washington, D C 20242 - Price $1.25 per set. Geological Survey Hydrologic Investigations Atlas HA-370, 2 sheets, 1971. Text, 13 fig, 5 map, 2 tab, 8 ref.

Descriptors: *Water resources development, *Groundwater, *Hydrogeology, *Water quality, *Colorado, Surface waters, Water yield, Chemical analysis, Water pollution sources, Oil industry, Oil shale, Mining, Pumping, Withdrawal, Groundwater recharge, Water quality control.
Identifiers: *Piceance Creek structural basin (Colo).

This atlas describes the availability, occurrence and chemical properties of the water resources for part of the Piceance Creek structural basin in northwestern Colorado. The area is between the White and Colorado Rivers, an area of about 1,600 square miles in parts of Rio Blanco, Garfield and Mesa Counties. The Piceance Creek basin contains some of the richest oil shale deposits in North America. These deposits represent a huge potential source of petroleum and efforts are currently being made to develop the resource. Some of the problems associated with the mining and retorting of oil shale are: removal of water from mines, supplying water for mining and retorting operations, supplying additional domestic water for an increase in population, effect of mining operations on present users of groundwater and surface water, and water-quality problems created by mining operations. Surface-water supplies in the basin are small and are completely developed. Pumping large quantities of groundwater from either the alluvium or from the leached zone of the Green River Formation would have adverse effects on present surface supplies. (Woodard-USGS)
W72-04330

BASIC DATA REPORT ON THE TURBULENT SPREAD OF HEAT AND MATTER,
Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 08B.
W72-04333

WIND-DRIVEN CURRENTS IN A LARGE LAKE OR SEA,
Northwestern Univ., Evanston, Ill. Dept. of Engineering Sciences; and Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02H.
W72-04335

SUMMARY OF ALLUVIAL-CHANNEL DATA FROM RIO GRANDE CONVEYANCE CHANNEL, NEW MEXICO, 1965 - 69,
Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 08B.
W72-04336

THE LOOK OF OUR LAND--AN AIRPHOTO ATLAS OF THE RURAL UNITED STATES: THE MOUNTAINS AND DESERTS.
Economic Research Service, Washington, D.C.
Available from GPO, Washington, DC 20402 Price $1.00. Department of Agriculture Handbook No 409, May 1971. 68 p, 39 ref.

Descriptors: *Land resources, *Water resources, *Aerial photography, *Southwest U.S., *Rocky Mountain Regions, Land use, Elevation, Topography, Climates, Water sources, Soil types, Deserts, Mountains.
Identifiers: *Western U.S., Atlas.

Airphotos illustrate land use patterns and terrain in two land resource regions in the Western United States. Portions of small-scale airphoto index sheets and a stereopair of airphotos accompany the description of 32 areas. The two regions are the Western Range and Irrigated Regions (545,200 sq mi) and the Rocky Mountain Range and Forest Region (236,800 sq mi). For each area within the regions descriptions of land use, elevation and topography, climate, water, and soil are included. (Woodard-USGS)
W72-04338

COMPUTER PROGRAMS IN USE IN THE WATER QUALITY DIVISION, VOL. 1,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
A. Demayo.
Canada Department of Energy, Mines and Resources Inland Waters Branch Report Series No 11, 1971. 28 p, 16 fig, 1 tab.

Descriptors: *Computer programs, *Systems analysis, *Input output analysis, *Water quality, *Water analysis, Mathematical models, Equations, Linear programming, Forecasting.
Identifiers: *Polynomial expressions.

This is one of a series of reports presenting computer programs in use in the Canadian Water Quality Division. This volume contains several 'Least square fit' programs and a program for finding the real or imaginary roots of a polynomial equation. These programs can be also used as subroutines in other programs. All programs in this report were written in FOCAL-69 and are used on a PDP-8/L - 8K computer. (Woodard-USGS)
W72-04343

ACCURACY OF DETERMINING AVERAGE VERTICAL VELOCITY (TOCHNOST' OPREDELENIYA SREDNEY NA VERTIKALI SKOROSTI),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 08B.
W72-04358

ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN WISCONSIN,
Wisconsin Geological Survey, Madison.
For primary bibliographic entry see Field 04A.
W72-04380

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE HOUSTON, TEXAS METROPOLITAN AREA, 1969,
Geological Survey, Houston, Tex. Water Resources Div.
S. L. Johnson.
Geological Survey Report, July 1971. 272 p, 19 fig, 15 tab, 7 ref.

Descriptors: *Watershed management, *Streamflow, *Urbanization, *Hydrologic data, *Texas, Data collections, Surface waters, Flow rates, Floods, Peak discharge, Average flow, Low flow, Water quality, Sediment transport, Cities, Water resources development, Water quality control, Sedimentation, Rainfall-runoff relationships, Chemical analysis.
Identifiers: *Urban hydrology, *Houston (Tex).

Hydrologic investigations of urban watersheds in Houston, Texas during the 1969 water year included data collections to determine the magnitude and frequency of flood peaks and flood volume, the effect of urban development on flood peaks and volume, and the variation in water quality during different flow conditions and different seasons. Runoff data are based on discharge measurements and stage records at 16 continuous-record stream-gaging stations, 16 partial-record stream-gaging stations and two reservoir-content stations. Annual records of daily discharges at continuous-record stream-gaging stations, maximum discharge at crest-stage partial-record stations, and daily contents of reservoirs are included. A comparison of runoff during the 1969 water year with the average runoff for the period of record is given. Water-quality data were collected at 12 gaging stations in the Houston urban area. These gaging stations are located in watersheds in various stages of urban development. (Woodard-USGS)
W72-04381

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1966: PARTS 3 AND 4. OHIO RIVER BASIN AND ST. LAWRENCE RIVER BASIN.
Geological Survey, Washington, D.C.
Available from GPO, Washington, D.C. 20402, Price $2.50. Geological Survey Water-Supply Paper 1992, 1970. 585 p, 1 fig, 32 ref.

Descriptors: *Water quality, *Water analysis, *Surface waters, *Ohio River, *St. Lawrence River, River basins, Chemical analysis, Data collections, Analytical techniques, Sediment transport, Sedimentation, Particle size, Water temperature, Streamflow, Flow measurement, Hydrologic data.
Identifiers: Basic data records.

Quality of water data for the Ohio River basin and St. Lawrence River basin are presented for the 1966 water year (October 1, 1965 to September 30, 1966). The Geological Survey maintained 222 stations on 142 streams for the study of chemical and physical characteristics of surface water. Samples were collected daily and monthly at 122 of these locations for chemical-quality studies. Samples were also collected less frequently at many other points. Water temperatures were measured continuously at 97 and daily at 72 stations. Quantities of suspended sediment are reported for 29 stations. Sediment samples were collected one or more times daily at most stations, depending on the rate of flow and changes in stage of the stream. Particle-size distributions of sediments were determined at 21 of the stations. The stream discharges reported in the tables are either daily mean discharges or discharges obtained at the time samples were collected. Discharges reported for composite samples are usually the average of daily mean discharges for the composite period. (Myers-USGS)
W72-04383

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1966: PARTS 12-16. NORTH PACIFIC SLOPE BASINS, ALASKA, AND HAWAII AND OTHER PACIFIC AREAS.
Geological Survey, Washington, D.C.
Available from GPO, Washington, DC 20402, Price $2.00. Geological Survey Water-Supply Paper 1996, 1971. 433 p, 1 fig, 32 ref.

Descriptors: *Water quality, *Water analysis, *Surface waters, *Alaska, *Hawaii, Data collections, Chemical analysis, Analytical techniques, Sediment transport, Sedimentation, Particle size, Water temperature, Streamflow, Flow measurement, Hydrologic data.
Identifiers: *North Pacific Slope basins, Basic-data records.

Quality of water data for the North Pacific Slope basins, Alaska, and Hawaii and other Pacific areas are presented for the 1966 water year (October 1, 1965 to September 30, 1966). The Geological Survey maintained 214 stations on 163 streams for the study of chemical and physical characteristics of surface water. Samples were collected daily and monthly at 78 of these locations for chemical-quality studies. Samples were also collected less frequently at many other points. Water temperatures were measured continuously at 133 and daily at 38 stations. Quantities of suspended sediment are reported for 31 stations. Sediment samples were collected one or more times daily at most stations, depending on the rate of flow and changes in stage of the stream. Particle-size distribution of sediments were determined at 26 stations. The stream discharges reported in the tables are either daily mean discharges or discharges obtained at the time samples were collected. Discharges reported for composite samples are usually the average of daily mean discharges for the composite period. (Myers-USGS)
W72-04384

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS, VOLUME 3. UPPER MISSISSIPPI RIVER BASIN BELOW KEOKUK, IOWA.
Geological Survey, Washington, D.C.

GPO, Washington, DC 20402-$3.00 (Paper cover). Geological Survey Water-Supply Paper 1915, 1971. 588 p, 1 fig, 1 plate.

Descriptors: *Data collections, *Surface waters, *Streamflow, *Mississippi River, Stream gages, Lakes, Reservoirs, Stage-discharge relations, Low flow, Peak discharge, River basins.
Identifiers: Surface water records, Upper Mississippi River basin.

One of a series of 37 reports presenting records of stage, discharge, and content, of streams, lakes, and reservoirs in the United States during the 1961-65 water years, this report covers the upper Mississippi River below Keokuk, Iowa. The data generally comprise a station description and a table showing daily discharge and monthly and yearly discharges. The station description gives the location of the gaging station, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. Type of gage currently in use and datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the record period are listed. Conditions affecting natural flow and information on accuracy of records are noted. Tables give daily, average, and extreme discharges and yearly totals and peak discharges. (Myers-USGS)
W72-04441

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1966: PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D.C.

GPO, Washington, D C 20402 - $3.50 (Paper cover). Geological Survey Water-Supply Paper 1994, 1971. 815 p, 1 fig, 32 ref.

Descriptors: *Water quality, *Water analysis, *Surface waters, *Mississippi River basin, Data collections, Chemical analysis, Analytical techniques, Sediment transport, Sedimentation, Particle size, Water temperature, Streamflow, Flow measurement, Hydrologic data.
Identifiers: Lower Mississippi River basin, Western Gulf of Mexico basins, Basic-data records.

Quality of water data for the Lower Mississippi River basin and the Western Gulf of Mexico basins are presented for the 1966 water year (October 1, 1965 to September 30, 1966). The Geological Survey maintained 262 sampling stations on 141 streams for the study of chemical and physical characteristics of surface water. Samples were collected daily and monthly at 248 of the locations for chemical-quality studies. Samples were also collected less frequently at many other points. Water temperatures were measured continuously at 6 and daily at 136 stations. Quantities of suspended sediment are reported for 24 stations. Sediment samples were collected one or more times daily at most stations, depending on the rate of flow and changes in stage of the stream. Particle-size distributions of sediments were determined at 60 of the stations. The stream discharges reported in the tables are either daily mean discharges or discharges obtained at the time samples were collected. Discharges reported for composite samples are usually the average of daily mean discharges for the composite period. (Myers-USGS)
W72-04442

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1966: PARTS 9-11. COLORADO RIVER BASIN TO PACIFIC SLOPE BASINS IN CALIFORNIA.
Geological Survey, Washington, D.C.

GPO Washington, D C 20402 Price $3.00 (Paper cover). Geological Survey Water-Supply Paper 1995, 1971. 726 p, 2 fig, 32 ref.

Descriptors: *Water quality, *Water analysis, *Surface waters, *Colorado River basin, *Pacific Coast region, Data collections, Chemical analysis, Analytical techniques, Sediment transport, Sedimentation, Particle size, Water temperature, Streamflow, Flow measurement, Hydrologic data.
Identifiers: Pacific Slope basins, Basic-data records.

Quality of water data for the Colorado River basin to Pacific slope basins in California are presented for the 1966 water year (October 1, 1965 to September 30, 1966). The Geological Survey maintained 307 stations on 181 streams for the study of chemical and physical characteristics of surface water. Samples were collected daily and monthly at 223 of the locations for chemical-quality studies. Samples were also collected less frequently at many other points. Water temperatures were measured continuously at 116 and daily at 68 stations. Quantities of suspended sediment are reported for 59 stations. Sediment samples were collected one or more times daily at most stations, depending on the rate of flow and changes in stage of the stream. Particle-size distributions of sediments were determined at 72 stations. The stream discharges reported in the tables are either daily mean discharges or discharges obtained at the time samples were collected. Discharges reported for composite samples are usually the average of daily mean discharges for the composite period. (Myers-USGS)
W72-04443

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 1. NORTH ATLANTIC SLOPE BASINS- VOL 3, BASINS FROM MARYLAND TO YORK RIVER.
Geological Survey, Washington, D.C.

GPO, Washington, D C 20402- Price $4.00 (Paper cover). Geological Survey Water-Supply Paper 1903, 1970. 850 p, 1 fig, 1 plate.

Descriptors: *Data collection, *Surface waters, *Streamflow, Northeast U.S., Lakes, Reservoirs, Stream gages, Stage-discharge relations, Low flow, Peak discharge.
Identifiers: *North Atlantic Slope basins, Surface water records.

One of a series of 37 reports presenting records of stage, discharge, and content, of streams, lakes, and reservoirs in the United States during the 1961-65 water years, this report covers the North Atlantic Slope basin from Maryland to York River. The data generally comprise a station description and a table showing daily discharge and monthly and yearly discharges. Station descriptions give the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. Type of gage currently in use and datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the record period are listed. Conditions affecting natural flow and information on accuracy of records are noted. Tables give daily, average, and extreme discharges and yearly totals and peak discharges. (Myers-USGS)
W72-04444

HYDROLOGIC CONTAMINATION PREDICTION METHODOLOGY,
Teledyne Isotopes, Palo Alto, Calif. Palo Alto Labs.
For primary bibliographic entry see Field 05B.
W72-04453

HYDROLOGIC RECORDS FOR VOLUSIA COUNTY, FLORIDA, 1970-71,
Geological Survey, Tallahassee, Fla.
C. P. Laughlin, and D. M. Hughes.
Geological Survey Open-file Report No 71009, 1971. 45 p, 30 fig, 8 tab, 3 ref.

Descriptors: *Data collections, *Streamflow, *Lake stages, *Florida, Hydrologic data, Groundwater, Water level fluctuations, Hydrographs, Rainfall, Chemical analysis, Water utilization, Water pollution sources.
Identifiers: Volusia County (Fla), Hydrologic records.

Streamflow records for the 1970 water year and lake levels, water quality data and groundwater levels through June of 1971 are presented. Located in east central Florida, the county has an area of approximately 1,200 sq mi and a 1970 population of 170,000. Mean monthly discharge and water quality data for four streamflow stations, periodic discharge and water quality data at two streamflow stations and two springs, and water level and water quality data for two lakes are given in graphic and tabular form. Graphs and tables are given of the water levels measured in 27 wells and chloride determinations for samples collected from 14 wells. Rainfall records at two stations in the county show 1970 was a dry year, particularly during the latter part. The dry spell continued into the early part of 1971. A water-level map shows groundwater levels in May 1971 were from one to four feet lower than they were in May 1970. The above average annual discharge for the 1970 water year at four streamflow stations was due to heavy rainfall during July, August and September 1969. Water quality analyses indicate values comparable to previous analyses. Water use data show a 32% increase between 1965 and 1970, mostly for municipal water systems. (Lang-USGS)
W72-04514

GROUND-WATER RESOURCES OF CHAMBERS AND JEFFERSON COUNTIES, TEXAS,
Geological Survey, Houston, Tex.
For primary bibliographic entry see Field 02F.
W72-04517

GROUND-WATER RESOURCES OF CASS AND MARION COUNTIES, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02F.
W72-04518

DATA FOR WELLS IN THE MODESTO--MERCED AREA, SAN JOAQUIN VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 04B.
W72-04519

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR LITTLE ELM CREEK, TRINITY RIVER BASIN, TEXAS, 1969,
Geological Survey, Austin, Tex.
B. B. Hampton.
Geological Survey Data Report, July 1971. 68 p, 2 fig, 3 tab.

Descriptors: *Streamflow, *Rainfall-runoff relationships, *Flood control, *Hydrologic data, *Texas, Data collections, Stream gages, Water yield, Flow measurement, Flow rates, Reservoirs, Floods, Levees, Hydrographs, Mass curves, Watershed management, Small watersheds.
Identifiers: *Little Elm Creek (Tex), *Aubrey (Tex), Floodwalls.

This report contains the rainfall, runoff, and storage data collected during the 1969 water year for the 75.5-square-mile area above the stream-gaging station Little Elm Creek near Aubrey, Texas. The locations of floodwater-retarding structures and hydrologic-instrument installations are shown. Average rainfall during the 1969 water year was 35.57 inches, or 96% of the 13-year average of 36.96 inches for the area. Monthly rainfall totals ranged from 0.03 inch in July to 8.25 inches in May. The yearly mean discharge was 39.9 cfs at the stream-gaging station near Celina and 53.2 cfs at the stream-gaging station near Aubrey. The runoff for the year at the Aubrey station was 38,500 acre-feet. At the Celina station, the annual runoff was 28,880 acre-feet. Two storm periods were selected for detailed computations. These computations include a detailed time breakdown of rainfall and discharge. Hydrographs and mass curves are presented. (Woodard-USGS)
W72-04534

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE SAN ANTONIO, TEXAS METROPOLITAN AREA, 1969,
Geological Survey, San Antonio, Tex.
L. F. Land.
Geological Survey Data Report, August 1971. 109 p, 1 fig, 2 tab, 3 ref.

Descriptors: *Streamflow, *Rainfall-runoff relationships, *Urbanization, *Hydrologic data, *Texas, Data collections, Watershed management, Stream gages, Water yield, Flow rates, Storms, Water quality, Chemical analysis, Hydrographs, Mass curves.
Identifiers: *San Antonio (Tex), *Urban hydrology.

This report presents a compilation and analysis of hydrologic data collected in the San Antonio, Texas urban area for the 1969 water year. The drainage basins were instrumented during the 1968 water year; therefore some data for that year are included. Precipitation data are based on 21 recording rain gages in the San Antonio metropolitan area . Runoff data are based on discharge measurements and stage records at 7 stream-gaging stations, 7 crest-stage partial-record stations, 1 reservoir station, and water-surface elevations at 4 flood-profile partial-record stations. Water-quality data were collected from watersheds in various stages of urban development. This water-quality program provides data on the concentration of pollutants as a result of runoff from these watersheds. In addition, these data provide a relationship of water-quality parameters to discharge and seasonal conditions. The importance of water quality in this area is unique because of the large amounts of surface-water runoff recharged to the Edwards and associated limestones, which is the major aquifer supplying groundwater for domestic supply, municipal supply, irrigation, and industrial use in the San Antonio area. (Woodard-USGS)
W72-04535

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE BRYAN, TEXAS METROPOLITAN AREA, 1969,
Geological Survey, Austin, Tex.
W. D. Robbins.
Geological Survey Data Report, August 1971. 49 p, 2 fig, 1 tab.

Descriptors: *Streamflow, *Rainfall-runoff relationships, *Hydrologic data, *Urbanization, *Texas, Small watersheds, Data collections, Flow measurement, Stream gages, Average flow, Flow rates, Watershed management, Storms, Hydrographs, Mass curves, Water yield.
Identifiers: *Bryan (Tex), *Urban hydrology.

This report contains the rainfall, runoff, and storage data collected during the 1969 water year for the Hudson Creek and Burton Creek watersheds in the vicinity of Bryan, Texas. Average rainfall over the Burton Creek study area during the water year was 49.67 inches or 27% more than the 30-year (1931-60) average. Mean daily discharge was 3.26 cfs and the total runoff was 2,360 acre-feet, or 33.24 inches (67% of rainfall). Average rainfall over the Hudson Creek study area during the water year was 49.36 inches, or 26% more than the 30-year (1931-60) average. Mean daily discharge was 2.42 cfs and the total runoff was 1,750 acre-feet, or 16.94 inches (34% of rainfall). Storms selected for analysis occurred on Feb. 14, 1969, Feb. 21, 1969, and May 8, 1969 in both the Burton Creek and Hudson Creek watersheds. In addition, a storm that occurred on July 9, 1968, (in the 1968 water year) is included. Computations with hydrographs and mass curves for each storm are included. (Woodard-USGS)
W72-04536

DATA GENERATING METHODS IN HYDROLOGY,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
G. W. Kite, and R. L. Pentland.
Canada Department of Energy, Mines and Resources Inland Waters Branch Technical Bulletin No 36, 1971. 32 p, 43 ref.

Descriptors: *Streamflow, *Hydrology, *Data processing, *Computer programs, *Systems analysis, Input-output analysis, Statistical methods, Stochastic processes, Floods, Droughts, Forecasting, Mathematical studies.

This report covers the background information necessary for hydrologic data generating techniques. Several of the techniques currently used are described. Most of these methods are available as computer programs and are relatively easy to use. One of the most important uses of data generation is in estimating floods, droughts or storage requirements at a given return period. While empirical or analytical techniques can give only one estimate of the design parameter, data generation can be used to obtain a best estimate of the design parameter and confidence limits on the estimate. An example of the efficiency of the data generation technique is given for estimating the maximum monthly discharge in any year, which will have a likely return period of 100 years from a record consisting of 30 years of mean monthly flows. An empirical or analytical solution, such as fitting a distribution to the annual maxima, would use only 30 pieces of information. The data generation technique would use all 30 x 12 segments of information in order to simulate a sequence of data from which the required parameter could be determined. (Woodard-USGS)
W72-04538

INTERLABORATORY QUALITY CONTROL STUDY NO. 1 - CALCIUM, TOTAL HARDNESS, SODIUM AND POTASSIUM,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 05A.
W72-04542

THE NATIONAL MANAGEMENT OF WATER RESOURCES,
Water Resources Board of England and Wales.
For primary bibliographic entry see Field 06A.
W72-04546

COMPREHENSIVE ANALYSIS OF THE ATTLEBORO WATER SYSTEM USING COMPUTER TECHNIQUES,
Whitmas and Howard, Inc., Boston, Mass.
S. J. Medlar.
Journal of the New England Water Works Association, Vol 85, No 3, p 259-281, September, 1971. 7 tab, 10 ref.

Descriptors: *Analog methods, *Computer programs, *Simulation analysis, Hazen-Williams equation, Networks, Pipes, Flow, Digital computers, Massachusetts.
Identifiers: Hardy Cross technique, *Attleboro (Mass).

The computer program used in this study utilized the Hardy Cross method. The paper illustrated, using the moderately sized Massachusetts City of Attleboro, how a computer can perform in the formulation of an overall systems analysis and design. Generally, in cases of severe flows, the computer's conclusions were conservative since skeletonizing the system and removing small mains somewhat decreased the carrying capacity of the network relative to the system. The technique used represented a compromise between a highly theoretical, statistical analysis of water consumption data and the often inaccurate rules of thumb. However, the accuracy of the input and printout data acquired by this method surpassed standard requirements. This example of Attleboro demonstrated how a designer, engineer, researcher or utility personnel could handle a highly sophisticated computer with relative ease. (Ligon-Cornell)
W72-04549

THERMAL PROPERTIES OF SEA WATER,
Hawaii Univ., Honolulu. Water Resources Research Center.
J. C. S. Chou.
Available from the National Technical Information Service as PB-206 796, $3.00 in paper copy, $0.95 in microfiche. Technical Report No. 49, June 1971. 50 p, 16 tab, 30 ref, 2 append. OWRR A-025-HI (1).

Descriptors: *Thermal properties, *Sea water, *Vapor pressure, *Specific heat, Aqueous solutions, Compressibility, Salinity, Temperature.
Identifiers: *Specific volumes.

The interpolation formulae for vapor pressures, specific volumes, enthalpies and heats of vaporization of ordinary sea water have been determined in the temperature range 0 deg. to 200 deg. C for salinities of 0 to 120 ppt, based on the published data. These formulae may facilitate calculations for designing desalting evaporators. The accuracies of vapor pressure data were found insufficient; however, the accurate measurements of vapor pressures by others are in progress. A close correlation was found between the compressibilities of sea water and those of aqueous sodium chloride solution at low temperatures. Because of the lack of experimental data on compressibilities of sea water at elevated temperatures, compressibilities of aqueous sodium chloride solution for pressures up to 350 atmospheres are used as approximations to those of sea water in order to account for the effect of pressure on other thermal properties.
W72-04582

ANALYSIS OF EPHEMERAL FLOW IN ARIDLANDS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 02E.
W72-04636

A COMPUTERIZED METHOD OF PRECIPITATION DATA QUALITY CONTROL,
Utah State Univ., Logan. Coll. of Engineering.
R. H. Campbell.
Utah Water Research Laboratory Report PRWG108-1, July 1971. 28 p, 7 fig, 1 tab, 3 ref, 3 append. Bur Reclam Contract No 14-06-D-6820.

Descriptors: *Precipitation (Atmospheric), *Data collections, *Data processing, *Computer programs, Computers, Remote sensing, Telemetry.
Identifiers: *Data quality control.

A computerized data quality check and data edit program was developed to aid in the processing of telemetered precipitation data. This program was used successfully in editing large amounts of precipitation data (75,000 data points per year) gathered by automated remote data acquisition techniques. The application of this processing routine has resulted in reducing data editing costs to about three percent of that required to do the work manually. All of the telemetered precipitation data for the 1969-70 and 1970-71 experimental seasons have been quality checked and edited by this program. The results agree well with manual editing. Methods used for the program are described. (Woodard-USGS)
W72-04657

WATER RESOURCES DATA FOR KANSAS - 1970: PART 2. WATER QUALITY RECORDS.
Geological Survey, Lawrence, Kans. Water Resources Div.

Geological Survey Basic Data Report, 1971. 159 p, 2 fig, 4 tab, 19 ref.

Descriptors: *Water quality, *Surface waters, *Groundwater, *Data collections, *Kansas, Annual, Chemical analysis, Water temperature, Sediment transport, Particle size, Discharge measurement, Flow rates, Hydrologic data, Aquifer characteristics, Water wells.
Identifiers: *Basic data.

Water-resources data for the 1970 water year (Oct. 1, 1969-Sept. 30, 1970) for Kansas include records of data for the chemical and physical characteristics of surface water and groundwater. Records for a few pertinent water-quality stations in bordering States are also included. The water-quality records for surface waters include descriptions of the sampling stations and tabulations of the data for the samples analyzed. The description of the sampling station gives the location, drainage area, periods of record for the various water-quality data, extremes of the pertinent data, and general remarks. For groundwater sampling sites, the well number, depth of well, date of sampling, and other pertinent data are given in the table containing the chemical analyses of groundwater. Tables include chemical, biological, microbiological, water temperature, and fluvial sediment data. (Woodard-USGS)
W72-04660

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE DALLAS, TEXAS METROPOLITAN AREA, 1969,
Geological Survey, Fort Worth, Tex.
G. R. Dempster, and B. S. Massey.
Geological Survey Data Report, July 1971. 136 p, 4 fig, 3 tab, 8 ref.

Descriptors: *Streamflow, *Rainfall-runoff relationships, *Urbanization, *Hydrologic data, *Texas, Cities, Data collections, Watershed management, Steam gages, Water yield, Flow rates, Storms, Hydrographs, Mass curves.
Identifiers: *Dallas (Tex), *Urban hydrology.

This report represents the compilation analysis of hydrologic data collected in urban or partly urban drainage basins in the Dallas, Texas metropolitan area during the 1969 water year. The Dallas urban studies involve the collection of precipitation, runoff, and flood-elevation data in 7 drainage basins within the city of Dallas and in 2 drainage basins outside the city in Dallas County. Two of the 7 study areas in Dallas have headwaters in rural areas outside the city limits, but the largest part of each drainage basiin is within the city. Total precipitation and rainfall intensities were determined from measurements at 34 recording rain gages. Runoff data were based on discharge measurements and stage records at 8 continuous-record stations and 13 crest-stage partial record stations. Water-surface elevations were obtained at 99 flood-profile locations. Annual records of daily discharges at continuous-record gaging stations, maximum discharge at crest-stage partial-record stations, and documented peak elevations at flood-profile partial-record stations are tabulated. (Woodard-USGS)
W72-04661

INDEX OF SURFACE WATER STATIONS IN TEXAS - OCTOBER 1971.
Geological Survey, Austin, Tex. Water Resources Div.

Geological Survey Report, October 1971. 28 p, 1 map, 5 tab.

Descriptors: *Data collections, *Hydrologic data, *Surface waters, *Documentation, *Texas, Information retrieval, Streamflow, Water quality, Chemical analysis, Sediment transport, Reservoirs.
Identifiers: *Index, *Surface water stations (Tex).

The U. S. Geological Survey's investigations of the water resources of Texas are conducted in cooperation with the Texas Water Development Board, Texas Highway Department, river authorities, cities, U. S. Corps of Engineers, Bureau of Sport Fisheries and Wildlife, Federal Water Pollution Control Administration, U. S. Soil Conservation Service, and others. This index shows the station number and name, type of records collected, and the office at which the basic data are permanently filed. As ot October 1, 1971, 482 streamflow, 75 reservoir-content, 14 stage, 113 low-flow partial-record, 192 crest-stage partial-record, 3 miscellaneous, 110 chemical quality, 25 continuous recording water-quality, 97 periodic chemical-quality, 149 periodic organic quality, 107 pesticides, 10 sediment, 33 periodic sediment, and 54 reservoir inventory stations were in operation. A map of Texas shows the data-collection sites. (Woodard-USGS)
W72-04662

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1967, PARTS 1 AND 2. NORTH ATLANTIC SLOPE BASINS AND SOUTH ATLANTIC SLOPE AND EASTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D. C.

Available from GPO, Washington, DC 20402-Price $4.00. Geological Survey Water-Supply Paper 2011, 1971. 982 p, 1 fig, 32 ref.

Descriptors: *Water quality, *Water analysis, *Surface waters, *Data collections, Northeast U.S., Southeast U.S., Gulf of Mexico, Analytical techniques, Sediment transport, Sedimentation, Particle size, Water temperature, Streamflow, Flow measurement, Hydrologic data.
Identifiers: North Atlantic Slope basins, South Atlantic Slope basins, Eastern Gulf of Mexico basins, Basic data records.

Quality of water data for the North Atlantic Slope basins and South Atlantic Slope and Eastern Gulf of Mexico basins are presented for the 1967 water year (October 1, 1966 to September 30, 1967). The Geological Survey maintained 318 sampling stations on 208 streams for the study of chemical and physical characteristics of surface water. Samples were collected daily and monthly at 262 of these locations for chemical-quality studies. Samples were also collected less frequently at many other points. Water temperatures were measured continuously at 83 and daily at 121 stations. Quantities of suspended sediment are reported for 53 stations. Sediment samples were collected one or more times daily at most stations, depending on the rate of flow and changes in stage of the stream. Particle-size distributions of sediments were determined at 35 stations. The stream discharges reported in the tables are either daily mean discharges or discharges obtained at the time samples were collected. Discharges reported for composite samples are usually the average of daily mean discharges for the composite period. (Myers-USGS)
W72-04663

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1966: PARTS 1 AND 2. NORTH ATLANTIC SLOPE BASINS AND SOUTH ATLANTIC SLOPE AND WASTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D.C.

Available from GPO, Washington, D C 20402-$4.00. Geological Survey, Water-Supply Paper 1991, 1971. 984 p, 1 fig, 32 ref.

Descriptors: *Water quality, *Water analysis, *Surface waters, *Data collection, Northeast U.S., Southeast, U.S., Gulf of Mexico, Analytical techniques, Sediment transport, Sedimentation, Particle size, Water temperature, Streamflow, Flow measurement, Hydrologic data.
Identifiers: North Atlantic Slope basins, South Atlantic Slope basins, Eastern Gulf of Mexico basins, Basic data records.

Quality of water data for the North Atlantic Slope basins and South Atlantic Slope and Eastern Gulf of Mexico basins are presented for the 1966 water year, (October 1, 1965 to September 30, 1966). The Geological Survey maintained 143 sampling stations on 99 streams for the study of chemical and physical characteristics of surface water. Samples were collected daily and monthly at 100 of these locations for chemical-quality studies. Samples were also collected less frequently at many other points. Water temperatures were measured continuously at 34 and daily at 32 stations. Quantities of suspended sediment are reported for 31 stations. Sediment samples were collected one or more times daily at most stations, depending on the rate of flow and changes in stage of the stream. Particle-size distributions of sediments were determined at 25 stations. The stream discharges reported in the tables are either daily mean discharges or discharges obtained at the time samples were collected. Discharges reported for composite samples are usually the average of daily mean discharges for the composite period. (Myers-USGS)
W72-04664

COMPUTATION OF STORM-FLOOD CHARACTERISTICS BY COMBINED ANALYSIS OF OBSERVATIONAL DATA ON A GROUP OF RIVERS (K RASCHETU KHARAKTERISTIK DOZHDEVYKH PAVODKOV PUTEM SOVMESTNOGO ANALIZA DANNYKH NABLYUDENIY PO GRUPPE REK),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W72-04681

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1967: PARTS 3 AND 4. OHIO

RIVER BASIN AND ST. LAWRENCE RIVER BASIN.
Geological Survey, Washington, D.C.

Available from GPO, Washington, DC 20402 $2.45. Geological Survey Water-Supply Paper 2012, 1971. 575 p, 1 fig, 32 ref.

Descriptors: *Water quality, *Water analysis, *Surface waters, *Ohio River, *St. Lawrence River, Analytical techniques, Sediment transport, Sedimentation, Particle size, Water temperature, Streamflow, Flow measurement, Hydrologic data.
Identifiers: Ohio River basin, St. Lawrence River basin, Basic data records.

Quality of water data for the Ohio River basin and St. Lawrence River basin are presented for the 1967 water year (October 1, 1966 to September 30, 1967). The Geological Survey maintained 237 sampling stations on 145 streams for the study of chemical and physical characteristics of surface water. Samples were collected daily and monthly at 144 of these locations for chemical-quality studies. Samples were also collected less frequently at many other points. Water temperatures were measured continuously at 101 and daily at 65 stations. Quantities of suspended sediment are reported for 34 stations. Sediment samples were collected one or more times daily at most stations, depending on the rate of flow and changes in stage of the stream. Particle-size distributions of sediments were determined at 22 stations. The stream discharges reported in the tables are either daily mean discharges or discharges obtained at the time samples were collected. Discharges reported for composite samples are usually the average of daily mean discharges for the composite period. (Myers-USGS)
W72-04689

THE LOOK OF OUR LAND--AN AIRPHOTO ATLAS OF THE RURAL UNITED STATES: THE EAST AND SOUTH.
Economic Research Service, Washington, D.C.

Available from GPO, Washington, D.C. 20402 - Price $1.25. Agriculture Handbook No 406, April 1971. 99 p, 39 ref.

Descriptors: *Land use, *Water sources, *Rural areas, *United States, *Aerial photography, Hydrologic data, Climates, Elevation, Topography, Soils, Surface waters, Groundwater, Forests, Vegetation, Agriculture.
Identifiers: Atlas (Airphoto).

Airphotos illustrate land use patterns and terrain in seven land resource regions in the Eastern and Southern United States. Portions of small-scale airphoto index sheets and a stereopair of airphotos accompany the description of each of the 41 areas within the regions. Information covering land use, elevation, topography, climate, water, and soil are included for each area. The land resource regions are: East and Central General Farming and Forest Region; Mississippi Delta Cotton and Feed Grains Region; South Atlantic and Gulf Slope Cash Crop, Forest, and Livestock Region; Northeastern Forage and Forest Region; Northern Atlantic Slope Truck, Fruit, and Poultry Region; Atlantic and Gulf Coast Lowlands Forest and Truck Crop Region; and Florida Subtropical Fruit, Truck Crop, and Range Region. (Woodard-USGS)
W72-04690

08. ENGINEERING WORKS

8A. Structures

THE WALDECK II STATION.
For primary bibliographic entry see Field 04A.
W72-04105

MODEL STUDY OF POWER INTAKE GATE OF MOSSYROCK DAM,
Western Canada Hydraulic Labos. Ltd. (British Columbia).
R. A. Robertson, and J. W. Ball.
Proceedings, American Society of Civil Engineers, Journal of the Hydraulics Division, Vol 97, No HY7, p 889-906, July 1971. 18 p, 16 fig, 1 ref, append.

Descriptors: *Roller gates, *Gate control, *Gates, *Model studies, *Prototype tests, Hydraulic structures, Hydraulic models, Penstocks, Friction, Damages, Vibration, Failure, Test procedures, Uplift pressure.
Identifiers: Mossyrock Dam (Wash), Friction tests.

The roller-mounted power intake gate on Mossyrock Dam fulfills 2 functions: close against maximum flow should the wicket gates fail, and fill the penstock and shaft through a small gate opening. When the gate was opened for the initial filling of the penstock, the gate catapulted high in the gate shaft, fell, and rebounded. Extensive damage to the gate, embedded sill, and the operating mechanism resulted. Tests were made on a 1:26 scale model of the gate and penstock to ascertain how each of the forces contributed to the catapulting action and to develop corrective measures. The model tests showed that the gate was catapulted up the shaft 50 ft. Major alterations to the gate shaft base would be required to prevent this action but were considered impractical for this installation. Conditions causing the model gate to stop at small openings while descending at slow speeds during simulated emergency closures are examined. Measures to assure model-prototype similarity and comparisons of model and prototype test data are presented. (USBR)
W72-04117

CRITERIA FOR DETERMINING ECONOMIC PRIORITIES IN AWARDING SEWAGE FACILITY CONSTRUCTION GRANTS,
Pennsylvania State Univ., University Park. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 05G.
W72-04286

FOREIGN DEEPWATER PORT DEVELOPMENT (THREE VOLUMES),
Little (Arthur D.), Inc., Cambridge, Mass.
For primary bibliographic entry see Field 06B.
W72-04553

SELECTED BIBLIOGRAPHY ON THE ENGINEERING CHARACTERISTICS OF COASTAL INLETS,
California Univ., Berkeley. Hydraulic Engineering Lab.
P. F. Castaner.
Available from the National Technical Information Service as AD-730 933. $3.00 in paper copy, $0.95 in microfiche. Hydraulic Engineering Laboratory Report No. HEL24-7, August 1971. 24 p.

Descriptors: *Coastal engineering, *Inlets (Waterways), *Bays, *Estuaries, Tides, Flow, Littoral drift, Sediments, Bibliographies, Lagoons, Harbors.
Identifiers: *Coastal inlets, *Tidal entrances.

Literature dealing with the engineering characteristics of coastal inlets was surveyed. A bibliography of 226 citations deal with the physical characteristics of coastal inlets, effects of waves, tides, flows, littoral drift and sediments, history of inlet improvement, based on theory and experience.
W72-04583

8B. Hydraulics

MODEL STUDY OF POWER INTAKE GATE OF MOSSYROCK DAM,
Western Canada Hydraulic Labos. Ltd. (British Columbia).
For primary bibliographic entry see Field 08A.
W72-04117

DRAG REDUCTION AND DEGRADATION OF DILUTE POLYMER SOLUTIONS IN TURBULENT PIPE FLOWS,
Naval Ship Research and Development Center, Washington, D.C.
T. T. Huang, and N. Santelli.
Available from NTIS Springfield, Va. 22151 as AD-730 052 Price $3.00 (paper cover): $0.95 cents microfiche. Naval Ship Research and Development Center Report 3677, Department of the Navy, August 1971. 36 p, 24 fig, 31 ref. SF 354 21 003, Task 01710.

Descriptors: *Turbulent flow, *Turbulent boundary layers, *Pipe flow, Testing, Analytical techniques, Velocity, Pressure head, Pressure drag, Hydraulics.
Identifiers: Drag reduction, Polymer solutions.

Drag reduction caused by dilute Polyethylene Oxide (POLYOXWSR-301) and anionic charged Polyacrylimide (MAGNIFLOC 835A) polymer solutions was studied experimentally in 1.918- and 0.455-cm ID smooth pipes. The POLYOX solutions tested were superior in drag reduction but inferior in shear-degradation resistance compared to the MAGNIFLOC solutions at corresponding concentrations. A three-layer mean velocity profile model appears to be more consistent with current and other data than a traditional two-layer model. (Woodard-USGS)
W72-04198

CHARACTERISTICS OF SEPARATED STORM AND COMBINED SEWER FLOWS,
Weston (Roy F.), Inc., Roslyn, N.Y.
For primary bibliographic entry see Field 05D.
W72-04302

BASIC DATA REPORT ON THE TURBULENT SPREAD OF HEAT AND MATTER,
Geological Survey, Fort Collins, Colo.
R. S. McQuivey, T. N. Keefer, and M. A. Shirazi.
Geological Survey Open-file Report, August 1971. 166 p, 31 fig, 9 tab, 5 ref, append.

Descriptors: *Hydrologic data, *Heated water, *Saline water, *Dispersion, *Hydraulic models, Laboratory tests, Turbulent flow, Jets, Flumes, Tracers, Research facilities, Research and development, Instrumentation, Transport depletion, Open channel flow, Thermal pollution.
Identifiers: *Colorado State University, Experimental procedure, Data summary.

Results are presented in basic data form of an investigation of the turbulent transport properties of heated and salt water jets in an open channel flow. The data were taken cooperatively by the U.S. Geological Survey and the Environmental Protection Agency and include measurement of the turbulence characteristics, longitudinal dispersion, and vertical and lateral turbulent diffusion. The apparatus and the experimental procedures are described. A flume 3.86 ft wide, 2 ft deep, and 120 ft long was used. Three different boundary roughnesses were used in the investigation. The turbulence data include the intensity of turbulence, Eulerian time scales, autocorrelation function distributions, space correlation distributions in the vertical and horizontal directions and space-time correlation function distributions in the longitudinal direction. Vertical and lateral turbulent diffusion data were obtained downstream from

jets of three diameters, at four different jets strengths. Two tracer fluids, heated water and a neutrally buoyant salt solution were used. Extensive analysis of these basic data will be the subject of a future publication. (Lang-USGS)
W72-04333

SUMMARY OF ALLUVIAL-CHANNEL DATA FROM RIO GRANDE CONVEYANCE CHANNEL, NEW MEXICO, 1965 - 69,
Geological Survey, Fort Collins, Colo.
J. K. Culbertson, C. H. Scott, and J. P. Bennett.
Geological Survey Open-file Report, August 1971. 168 p, 22 fig, 8 tab, 17 ref, 2 append.

Descriptors: *Streamflow, *Sediment transport, *Conveyance structures, *Rio Grande, *New Mexico, Channels, Channel flow, Sediment discharge, Sedimentation, Particle size, Sediment distribution, Sediment load, Sampling, Flow measurement, Flow rates.
Identifiers: *Rio Grande Channel (Bernardo, N Mex).

Flow and sediment data are presented for the 6.8 mile Rio Grande conveyance channel near Bernardo, New Mexico. The channel bed consists of sands with median diameters ranging from 0.15 to 0.35 mm and the bedform varies from dunes to flat. Descriptions of equipment and general procedures of sampling are followed by descriptions of two sets of data; the first set is a series of measurements taken at individual cross-sections and describes conditions at points along the reach. The second set is a series of measurements that characterize the entire length of the Bernardo reach of the conveyance channel system. The data include water discharge, cross-sectional area, channel width, slope, point velocity, point-integrated sediment concentration, depth-integrated sediment concentration, and bed material. Data were obtained for water discharges ranging from 560 to 1,860 cfs and slopes ranging from 0.00041 to 0.0011. Cross-sectional area variations were from 143 to 425 sq. ft. Suspended-sediment concentrations ranged from 1,240 to 7,700 mg/liter. (Woodard-USGS)
W72-04336

DISPERSION OF THERMAL EFFLUENTS,
Washington State Univ., Pullman. Coll. of Engineering.
For primary bibliographic entry see Field 05B.
W72-04352

ACCURACY OF DETERMINING AVERAGE VERTICAL VELOCITY (TOCHNOST' OPREDELENIYA SREDNEY NA VERTIKALI SKOROSTI),
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
M. L. Ruppert.
In: Sbornik rabot po gidrologii, No 9; Gosudarstvennyy Gidrologicheskiy Institut, Leningrad, Gidrometeoizdat, p 181-188, 1970. 2 fig, 2 tab, 14 ref.

Descriptors: *Velocity, *Channel flow, *Flow measurement, *Hydrometry, Open channels, Ice, Seasonal, Equations, Probability.
Identifiers: *USSR, *Distribution curves, Gaussian-Chebyshev formulas, Simpson formula.

The accuracy of determining average vertical velocity by various methods of interpolation between measured water flow velocities is examined. Chebyshev and Gaussian formulas for 2- and 3-ordinates were used in addition to the currently popular formula of trapezoids. A total of 236 vertical velocity distribution curves, with depths ranging from 0.3 to 17 m, were analyzed--120 for open channels and 116 for channels under ice. Parabolic interpolation after Simpson, calculated for 11 evenly distributed points, was used as the standard average velocity value. Probability of error using 3-point Chebyshev and Gaussian formulas for any channel state to compute average vertical velocity for most frequently encountered distributions does not exceed 1%. Use of the 2-point Chebyshev-Gaussian formula produces small random errors with a probability error for summer curves of 1.7% and for winter curves of 2.6%. These methods result in pratically no systematic errors, whereas interpolation by the trapezoid formula produces both large random and systematic errors. The multipoint method of measurement with curvilinear interpolation after Chebyshev, Gauss or Simpson should be used in vertical velocity distribution studies. (Josefson-USGS)
W72-04358

METHOD OF RATING FLOW IN A STORM SEWER,
Geological Survey, Mineola, N. Y.
For primary bibliographic entry see Field 07B.
W72-04363

ANALYSIS OF FORCES IN A PILE-UP OF ICE,
Monti, Lavoie and Nadon, Montreal (Quebec).
For primary bibliographic entry see Field 02C.
W72-04528

EFFECTIVE FORCE OF FLOATING ICE ON STRUCTURES,
Monti, Lavoie and Nadon, Montreal (Quebec).
For primary bibliographic entry see Field 02C.
W72-04529

COMPUTATION OF GRAVITY CURRENTS IN ESTUARIES,
For primary bibliographic entry see Field 02L.
W72-04540

TRIBUTARY TO THE INTRACOASTAL WATERWAY AT INTERSTATE HIGHWAY 10 NEAR PORT ALLEN, LOUISIANA,
Geological Survey, Baton Rouge, La.
L. A. Martens, and B. L. Neely, Jr.
Geological Survey Open-file Report, April 1970. 4 p, 3 fig.

Descriptors: *Streamflow, *Floods, *Culverts, *Backwater, *Louisiana, Flow profiles, Flow rates, Urbanization, Hydraulic structures, Roads, Regional flood, Design flood, Flood control.
Identifiers: *Port Allen (La), Urban hydrology.

The Louisiana Department of Highways has built a triple 10 x 10 box culvert at crossing of a tributary to the Intracoastal Waterway. Information is presented concerning the elevation and discharge of the 50-yr flood and the effect that the culvert will have on the flood elevations upstream from the highway. The basin is sparsely developed (about 10%) above Interstate 10. The 50-yr discharge is estimated to be 1,580 cfs. Because of its proximity to Baton Rouge, the basin will become urbanized to a greater extent in the future. The 50-yr stage at the upstream side of the culvert under rural conditions would be 9.3 ft which reflects about 0.2 ft backwater caused by the culvert; the 50-yr stage after full urbanization would be 12.7 ft which would have about 1.3 ft of backwater at the culvert. (Woodard-USGS)
W72-04659

LASER-VELOCITY METER,
Lund Univ. (Sweden). Div. of Hydraulics.
For primary bibliographic entry see Field 07B.
W72-04671

UNCONFINED FLOW AROUND INCLINED SHEET PILES,
Indian Inst. of Science, Bangalore. Dept. of Civil and Hydraulic Engineering.
A. S. Reddy, G. C. Mishra, and K. Seetharamiah.
Journal of Hydraulic Research, Vol 9, No 4, p 591-607, 1971. 10 fig, 5 ref.

Descriptors: *Groundwater movement, *Flow around objects, *Piles (Foundations), *Sheet piling, Porous media, Alluvial channels, Porosity, Permeability, Pressure.
Identifiers: *Flow around sheet piles.

The pressure distribution and position of phreatic lines, in the case of unconfined flow around oblique sheet piles embedded in an infinitely deep, homogeneous, and isotropic porous medium are determined using the hydrograph and method of inversion. The analysis is valid for any inclination of the sheet pile. Numerical results are presented for various angles and several different depths of embedment. (Knapp-USGS)
W72-04675

PROBLEMS OF ENGINEERING HYDROLOGY (VOPROSY INZHENERNOY GIDROLOGII).
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W72-04678

8C. Hydraulic Machinery

SIMULATION OF EHV TRANSMISSION LINE FLASHOVERS INITIATED BY BIRD EXCRETION,
Bonneville Power Administration, Portland, Oreg.
H. J. West, J. E. Brown, and A. L. Kinyon.
Institution of Electrical and Electronics Engineers, Transactions, Power Applications Systems, Vol PAS-90, No 4, p 1627-1630, July-Aug 1971. 4 p, 8 fig, 4 ref.

Descriptors: *Transmission lines, *Extra high voltage, *Birds, Electrical insulators, Alternating current, Direct current, Field investigations, Laboratory tests, Simulation, Test procedures.
Identifiers: *Outages, *Flashover, Contaminants, Air gaps, Electric discharges, Test results.

During 1968 and 1969, unexplained flashovers caused 32 outages on the Bonneville Power Administration 500-kv a-c transmission lines. Outage statistics were studied and field investigations made to determine flashover causes. Insulator specimens exhibiting evidence of flashover were removed and tested in the laboratory fog chamber under extremely wet conditions. Tests demonstrated that greater quantities of a contaminant than found on the specimens, would have to be present in field installations to cause flashovers initiated by rain or fog. The theory was then advanced that flashover occurs as a result of long streams of excrement released by large birds, either perched on or in flight near a transmission tower, partially bridging the gap between the tower and conductors. A discharge device, simulating that situation was developed for controlled experiments. Test results show that a 50 to 60 cu cm discharge can produce 8 to 9 ft conductive streams, thus bridging gaps to within strike distance of both 320-kv a-c and 400-kv d-c line-to-ground air gaps. (USBR)
W72-04104

RELIABILITY CALCULATIONS INCLUDING THE EFFECTS OF OVERLOADS AND MAINTENANCE,
Stagg Systems, Inc., New York.
W. R. Christiaanse.
Institution of Electrical and Electronics Engineers, Transactions Power Application Systems, Vol PAS-90, No 4, p 1664-1667, July-Aug 1971. 14 p, 10 fig, 6 tab, 23 ref, append, disc.

Descriptors: *Reliability, *Maintenance, Probability, Mathematical models, Bibliographies, Electric power, *Electric power production, Networks, Electrical equipment, Electric power failure, Failure (Mechanics), Electric power demand.
Identifiers: *Outages, *Overloads.

A difficult problem associated with reliability calculations has been the development of accurate and simple methods for representing the combined effects of: device outages due to external forces, outages contingent on the load level and other outages, and planned outages for maintenance. System loads, maintenance outages, and forced outages can be represented as 2-stage, statistically independent renewal processes, leading to a simplified method for calculating the steady-state rates and contingency durations. These methods are generally more accurate than those using availability load models. The effects of load growth on reliability are examined. Two sample problems using the models are included. (USBR)
W72-04107

A NEW METHOD FOR FORECASTING HOURLY DEMANDS,
Hydro-Electric Power Commission of Ontario, Toronto.
For primary bibliographic entry see Field 06D.
W72-04109

ANALYSIS OF JET-TYPE IMPULSE TURBINES,
University of Strathclyde, Glasgow (Scotland).
J. Webster.
Water Power, Vol 23, No 8, p 287-292, Aug 1971. 6 p, 6 fig, 2 ref.

Descriptors: *Hydraulic machinery, *Impulse turbines, *Pelton turbines, *Hydraulic turbines, Losses, Friction, Jets, Turbines, Foreign research.
Identifiers: Great Britain, *Specific speed, *Turbine efficiency, Entrances (Fluid flow), Kinetic energy.

Jet-type impulse turbine performance can be assessed from inlet flow conditions. The inclined-jet turbine is inherently less efficient than the tangential-jet or Pelton turbine, both by virtue of the geometrical configuration and the range of specific speeds. Reasons for this lower efficiency are given; a general one-dimensional theory is developed; and the effects of relevant variables are discussed. Energy loss is primarily attributed to the relative energy differential across the jet at the inlet, resulting in a mixing effect and an outward turning moment on the fluid. The bulk of the fluid thus leaves the wheel at a radius greater than that at entry, resulting in higher friction and exit losses. (USBR)
W72-04112

GEOTHERMAL POWER,
For primary bibliographic entry see Field 04B.
W72-04172

EVALUATION OF SELECTED EARTHMOVING EQUIPMENT FOR THE RESTORATION OF OIL-CONTAMINATED BEACHES.
URS Research Co., San Mateo, Calif.
For primary bibliographic entry see Field 05G.
W72-04296

8D. Soil Mechanics

STRUCTURAL CHARACTERISTICS OF GRANULAR POROUS MEDIA,
Instituto Mexicano del Petroleo, Mexico City.
C. Perez-Rosales, and J. J. Martinez.
Society of Petroleum Engineers Journal, Vol 11, No 4, p 363-366, December 1971. 1 fig, 1 tab, 9 ref.

Descriptors: *Porous media, *Porosity, *Fluid mechanics, *Groundwater movement, *Statistical methods, Sedimentology, Particle size, Granules, Soil mechanics, Stratigraphy, Petrography.

A statistical method, based upon the surface analysis of samples, is presented for determining simultaneously the following structural characteristics of granular porous media: porosity, mean pore width, mean grain thickness, specific surface, true sphericity of grains, number of grains per unit volume, and surface area of individual grains. Since a two-dimensional analysis is used as a means for obtaining information about three-dimensional systems, the applicability of the proposed method is restricted to homogeneous and isotropic media. The study of the geometrical properties of granular porous media is of importance in a variety of scientific and technilogical disciplines, such as fluid mechanics, soil mechanics, sedimentology, stratigraphy, and petrophysics. (Woodward-USGS)
W72-04385

DETERMINATION OF THE ACOUSTIC PROPERTIES OF FROZEN SOILS,
Cold Regions Research and Engineering Lab., Hanover, N.H.
For primary bibliographic entry see Field 02C.
W72-04550

SEEPAGE CHARACTERISTICS OF EXPLOSIVELY PRODUCED CRATERS IN SOIL AND ROCK,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08H.
W72-04552

BRINEFIELD SUBSIDENCE AT WINDSOR, ONTARIO,
R. Terzaghi.
Paper presented at Third Salt Symposium, Cleveland, Ohio, April 23, 1969, and published as Harvard University Soil Mechanics Series No. 84, 1970.

Descriptors: *Subsidence, *Settlement (Structural), *Subsurface investigations, Soil profiles, Saline soils, Wells, Cavitation.
Identifiers: Brinefields, Windsor, Ontario (Canda).

In 1948, settlement cracks were noticed in fuildings within the Sandwich brine field area of Windsor, Ontario, Canada. Thereupon about 85 reference points were established on structures in the area. Changes in elevation of these points were measured at yearly intervals. The results of the second annual survey indicate that a shallow bowl of subsidence with a radius of 1000 feet had developed. The bowl continued to deepen at an accelerating rate. In 1954 a rapid subsidence took place in the central part of the bowl. Within a few hours, a water-filled depression, about 500 feet in diameter and more than twenty-five feet in maximum depth, was formed. Subsequent investigations indicated that the subsidence was the result of the collapse of the roof of one or more cavities in underlying salt beds produced by brine extraction from salt deposits located at depths in excess of 1000 feet below the surface of the ground.
W72-04584

8E. Rock Mechanics and Geology

SEEPAGE CHARACTERISTICS OF EXPLOSIVELY PRODUCED CRATERS IN SOIL AND ROCK,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08H.
W72-04552

8G. Materials

DEVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST CORROSION IN HOT SEA WATER,
Westinghouse Electric Corp., Pittsburgh, Pa.
For primary bibliographic entry see Field 03A.
W72-04212

THE FLEXURAL STRENGTH OF SEA ICE AS DETERMINED FROM SALINITY AND TEMPERATURE PROFILES,
Cold Regions Research and Engineering Lab., Hanover, N.H.
For primary bibliographic entry see Field 02C.
W72-04526

CHEMICAL CONTROL OF CORROSION,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 05F.
W72-04649

8H. Rapid Excavation

INFILL OF NUCLEAR RUBBLE CHIMNEYS BY GROUND WATER,
Teledyne Isotopes, Palo Alto, Calif.
For primary bibliographic entry see Field 05B.
W72-04451

REPORT OF OFF-SITE SURVEILLANCE FOR PROJECT CABRIOLET.
Southwestern Radiological Health Lab., Las Vegas, Nev.
For primary bibliographic entry see Field 05B.
W72-04455

SEEPAGE CHARACTERISTICS OF EXPLOSIVELY PRODUCED CRATERS IN SOIL AND ROCK,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
W. C. Sherman, Jr., and Don C. Banks.
Available from the National Technical Information Service as AD-731 454, $3.00 in paper copy, $0.95 in microfiche. WES Misc. Paper S-69-34, August 1969, 90 p. 52 ref.

Descriptors: *Craters, *Excavation, *Soil properties, *Rock properties, *Seepage, Permeability.
Identifiers: *Explosion effects, *Rapid excavation.

This report contains a review of the permeability characteristics of soil and rock formation in both disturbed and undisturbed conditions which are likely to occur in the zones surrounding craters. The report presents methods of determining permeability and tabulates typical values of permeability in a variety of materials. Factors which affect the seepage characteristics of craters are discussed and a few examples are presented to illustrate the influence of seepage on stability calculations. The data indicate that laminar flow conditions will prevail in soil and rock formations dependent upon the size of the pore opening and velocity gradient. For a given pore opening, a critical gradient exists above which the flow is found to be turbulent; the technique of constructing flow nets for turbulent flow is illustrated in the report. The correct assessment of seepage conditions in the zones surrounding a crater will depend to a large extent upon the correct evaluation of boundary conditions such as geological discontinuities and sources of seepage.
W72-04552

EXCAVATION SEISMOLOGY,
Honeywell, Inc., St. Paul, Minn. Systems and Research Center.
E. Soland, H. M. Mooney, and S. Singh.
Available from the National Technical Information Service as AD-731 707, $3.00 in paper copy, $0.95 in microfiche. Advanced Research Projects Agency Contract Report No. 12289-TR1, September 1971, 136 p. Bureau of Mines Contract HO210025.

Descriptors: *Excavation, *Seismology, *Seismic waves, *Instrumentation.

Identifiers: *Rapid excavation, *Seismic models, *Seismic array processing, *Seismic reflection method, Piezoelectric transducer.

The objective of the program is to develop seismic techniques and equipment which can be used in a hard-rock rapid-excavation system to provide indication of potentially hazardous or changing geologic conditions ahead of the working face. The seismic reflection method is considered the most suitable one for the application. The principal technical problem is identification of reflections superimposed on other source-produced coherent interference. Signal processing techniques such as cross-correlation and velocity filtering or beam-forming using an array of receiving sensors are being investigated for enhancement of reflections. The initial part of the program has emphasized the development of a seismic source/receiver combination which produces a simple, repeatable transmitted seismic pulse. A field recording system has been assembled and seismic signals recorded and digitized for reflections from free surfaces on granite blocks using a single receiver at various locations to simulate an array of receivers. The digitized signals will subsequently be processed by digital computer to simulate and assess signal processing techniques.
W72-04586

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

INDEX TO RESEARCH ON COASTAL AND ESTUARINE WATERS IN THE UNITED STATES,
Pacific Northwest Water Lab., Corvallis, Oreg.
For primary bibliographic entry see Field 02L.
W72-04209

ANNUAL REPORT.
North Carolina Water Resources Research Inst., Raleigh.

Available from the National Technical Information Service as PB-206 696, $3.00 in paper copy, $0.95 in microfiche. July 1, 1970-June 30, 1971, 27 p. OWRR-A-999-NC (27).

Descriptors: *Education, *Research facilities, Grants, Universities, *North Carolina, Water resources, Research and development, Training, *Projects.

The Water Resources Research Institute is The University of North Carolina's water research center. Located at North Carolina State University at Raleigh, the Institute serves all campuses of The University of North Carolina. It works closely with the Department of Natural and Economic Resources and other agencies in the formulation of a research program responsive to state water resource problems. A twenty-six-man Advisory Committee representative of state and federal water agencies, industry, conservation, agriculture, local government, and the general public provides program guidance and review. The Institutes's research program for fiscal year 1970-1971 was supported by an annual allotment and eleven matching grants from the Office of Water Resources Research, U. S. Department of the Interior; matching state appropriations; matching funds from the Texas Gulf Sulphur Company; and a grant from the Z. Smith Reynolds Foundation. All senior colleges and universities in North Carolina are eligible to participate in the Institute's program. In FY 1970-1971 projects were conducted at North Carolina State University at Raleigh, University of North Carolina at Chapel Hill, and East Carolina University at Greenville.
W72-04631

9D. Grants, Contracts, and Research Act Allotments

ANNUAL REPORT.
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 09A.
W72-04631

10. SCIENTIFIC AND TECHNICAL INFORMATION

INDEX TO RESEARCH ON COASTAL AND ESTUARINE WATERS IN THE UNITED STATES,
Pacific Northwest Water Lab., Corvallis, Oreg.
For primary bibliographic entry see Field 02L.
W72-04209

DETERGENTS IN WATER - A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.
For primary bibliographic entry see Field 05B.
W72-04438

PCB IN WATER - A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.
For primary bibliographic entry see Field 05A.
W72-04439

MERCURY IN WATER-A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.
For primary bibliographic entry see Field 05B.
W72-04440

TERRESTRIAL AND FRESHWATER RADIOECOLOGY. A SELECTED BIBLIOGRAPHY,
Division of Radiation Protection Standards (AEC), Washington, D.C.
For primary bibliographic entry see Field 05C.
W72-04452

U. S. PATENT ABSTRACTS AND INDEXES COVERING THE TECHNOLOGY OF DISTILLATION PROCESSES FOR SALINE WATER CONVERSION,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03A.
W72-04575

SELECTED BIBLIOGRAPHY ON THE ENGINEERING CHARACTERISTICS OF COASTAL INLETS,
California Univ., Berkeley. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 08A.
W72-04583

ANNOTATED BIBLIOGRAPHY ON FRESHWATER ICE.
Lake Survey Center, Detroit, Mich.
For primary bibliographic entry see Field 02C.
W72-04585

BIBLIOGRAPHY OF HYDROLOGY X, 1969, (HIDROLOGIAI BIBLIOGRAFIA X. 1969).

Vizdok, Budapest, Hungary, 1971. 181 p.
Descriptors: *Water resources, *Foreign research, *Bibliographies, *Publications, Information retrieval, Meteorology, Watersheds (Basins), Lakes, Glaciers, Groundwater basins, Springs, Water balance, Water resources development, International Hydrological Decade.
Identifiers: *Hungary, Hydrological bibliography.

This is Volume 10, Hungarian Hydrological Bibliography, which conforms to the system of the International Hydrological Bibliography initiated by the International Union of Geodesy and Geophysics. The bibliography is arranged in eight major headings: hydrometeorology, watercourses, lakes, glaciers, subsurface waters, and springs, water balance and water development, application of other sciences in hydrology, and general works. The volume reports titles and bibliographical information for 482 books, periodicals, and other documents published in Hungary in 1969. Tables of contents and titles are presented in English, Russian, and German. (Lang-USGS)
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- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the Soap and Detergent Association and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Public water supply treatment technology at the American Water Works Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.
- Water treatment plant waste pollution control at American Water Works Association.

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